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HISTORY
of
Massachusetts
Industries

Their Inception, Growth
and Success

By
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CHAPTER XLV

QUINCY

THE GRANITE CITY OF MASSACHUSETTS

The story of Quincy as an industrial city is the tale of its last one hundred years.

Its development along manufacturing lines but accentuates the fact that not until the inventive genius of man had conceived and applied devices that could economically be employed, its latent natural resources, probably as extensive as any within the confines of the Commonwealth, lay practically untouched.

But in 1825 the scene changed and the transformation that followed was due solely to the fact that the abilities of far-seeing Massachusetts industrialists were brought into play, with the result that the granite deposits of Quincy were uncovered, and became the greatest asset of the community.

In that year, Gridley Bryant, of Scituate, on behalf of the Bunker Hill Monument Association, bought a quarry at West Quincy, the stone of which had been approved by Solomon Willard, of Petersham, and to this deposit was applied the name of Bunker Hill Quarry.

The fame of Quincy granite was then and there proclaimed to the world.

True it is that from 1749 to 1752 upper layers of the local syenite formation had been taken from the top of the deposits to build King's Chapel and, later, the old Governor Hancock mansion, on Beacon Street, Boston. But so meagre a conception of the local granite resources was possessed by the natives that for decades the situation was discussed at town meetings in old Braintree—the municipal mother of modern Quincy—and new methods of even more stringent husbanding of these natural assets of the community were considered to avert what was then popularly regarded as a dissipation and ultimate exhaustion of the supply.

In 1753, after King's Chapel was completed, a vote was passed by the citizens forbidding the removal of any more stones from the "commons" until otherwise ordered.

Thus the situation remained in *status quo* until a Sunday in the year 1803, a day now memorable in the annals of the city, when there appeared at Newcomb's Tavern, in North Quincy, three men—Josiah Bemis, George Stearns and Michael Ward—who feared not the tithingman and who had split a large piece of granite by employing iron wedges. The crust of the syenite hills of old Quincy was broken, but the proper tools and appliances for the commercial development of the industry were still lacking, and although slabs were removed for door steps, foundations and gable walls of buildings, the problems of handling and dressing the granite, and the cartage of the product remained unsolved until Samuel Willard developed the drills, derricks and shops, and Gridley Bryant built the railway, which proved to be the most notable accomplishment that occurred in the administration of a son of Quincy—President John Quincy Adams.

THERE WERE OBJECTORS EVEN IN THOSE DAYS

When Bryant approached the Great and General Court for a charter for the Granite Railway he encountered objections of the most strenuous nature. For quite a period of time the project was in jeopardy. Whoever heard of a railway? inquired some members of the House. What practical use will it be, how can it be operated, and what will be its effect, if successful, on the available supply of granite?, were some of the queries submitted by the legislative objectors.

By a scant majority the Legislature voted a charter and work was begun on the railway in April, 1826, and the last rail was spiked on October 7th following, on which day the first train of cars passed over the entire four miles of construction.

It was an eventful occasion for Quincy when this, the first railway in America, was opened. It had cost \$50,000, and led from the Bunker Hill Quarry via an inclined plane by which an 84 foot vertical fall was accomplished in 315 feet of gradual descent, to tide water on the Neponset River. Stone "sleepers" or ties, placed eight feet apart, supported the original wooden rails of pine, covered with oak tops, which later were superseded by stone rails, and for more than forty years thereafter the railway was operated by horse power.

Bryant had no precedents upon which to work, yet he successfully devised and installed the necessary switches, portable derricks, turn table and the movable trucks for the eight wheeled cars that were built. He failed to protect his inventions by patents and died a comparatively poor man.

Over the rails of this pioneer and primitive railway were carried all the blocks of granite that fashioned the Bunker Hill Monument, and over it also for decades afterward moved the slabs that were cut from the inexhaustible deposits of Quincy.

Exactly forty-five years from the day the railway had been opened in 1826, the Old Colony Railroad Company purchased the right of way and the assets of the Granite Railway and laid its irons, thus making it possible to write into American history the fact that its successor, the New York, New Haven and Hartford Railroad Company can lay claim to being the oldest railroad in the United States.

With the completion of the Granite Railway, Quincy granite found its rightful place in the industrial sun. The old Tremont House in Boston, the Federal Court House in the same city, the old Masonic Temple, and the old Boston Custom House, with its thirty monolith columns, each weighing forty-two tons, as well as many other structures, were fashioned out of Quincy granite. Running from the quarry to tide water the original railway rendered it possible to successfully transport the giant blocks and columns that entered into the construction of public and private buildings all over New England.

Finally a new school of architecture appeared on the horizon which, deciding that Quincy granite was so hard and cold in appearance and so durable in its component parts that it was wont to outlive its usefulness, the quarries of the city turned to a new field for distribution and today three-fourths of all that is quarried finds a location in the cities of the dead, where the enduring qualities of the world-famous Quincy deposits of syenite tell their silent stories of the advent and the passing of man.

By 1875, less than fifty years after the railway was opened there had come into existence thirty-seven quarrying corporations or partnerships in Quincy, capitalized at \$588,200, employing 617 men, and producing granite valued at \$775,884.

TODAY'S PICTURE OF THE LOCAL GRANITE INDUSTRY

Today, there are between eighty-five and ninety concerns operating in the city in the granite industry, the majority of them quarrying and marketing completed or unfinished memorials and monuments, capitalized at \$3,022,859, employing 750 men to whom are annually paid in wages \$1,350,000, using stock and materials valued at \$1,250,000 and manufacturing products valued at almost \$4,000,000. Not very much ocular evidence of a decline in this industry is observed in these figures as compared with those of 55 years ago.

The advent of these granite quarries has also had the effect of centering in the city many other concerns, whose products are collateral to the granite industry, such as machine and tool shops engaged in manufacturing devices used in quarrying operations, engine manufacturers, steel casting concerns, and others.

Next to the Bethlehem Shipbuilding Corporation the granite industry of Quincy employs more workers than any other type of local industry, and ranks second in the value of its products.

As early as 1700 Quincy had a tannery and several others were set up in after years, the pioneer unit continuing operations there until 1825.

Shoe manufacturing was begun there in 1795 and in 1856 this industry employed 400 hands. Infant's shoes are still made in the city.

THE MOST EFFICIENT SHIP-BUILDING PLANT NORTH OF NEW JERSEY

Caviling critics of Massachusetts take delight in harking back to the days of yore, when the sailing ship was mistress of the seas, prior to the time when steam and oil-burning vessels assumed their sway of ocean commerce, and, without the slightest recognition of the perfectly obvious fact that modes and methods of water transportation are today entirely different from those which prevailed in the fifties, they point to the supremacy then held by the ship builders of the Commonwealth, and especially those of Boston, and its environs, in the construction of the white-winged racers of the clipper-ship era, and emphasize in their mistaken zeal that Massachusetts is no longer to be reckoned with in the production of ocean tonnage.

They merely exhibit their ignorance of the present day fact that four decades ago fertile fields of idle terrain existed where now stands the plant of the Bethlehem Shipbuilding Corporation, in Quincy, consisting of eighty buildings, employing about 3,500 workmen, with a capacity to turn out a fleet of gigantic ships in a single year, if necessary, that would exceed in tonnage and numbers that vast galaxy of argosies designed and built by Donald McKay, Samuel Hall, the Briggs Brothers, and a dozen other ship builders, whose products, in their day, marked an era in the merchant marine.

THE BAY STATE IS STILL BUILDING SHIPS—MORE, BIGGER AND BETTER

Critics fail to recognize that today the ships launched from the Quincy plant sail the seven seas, and that there is no ship building plant north

of New Jersey so completely equipped to serve the needs of the United States and of foreign nations as that of the Bethlehem unit.

It was not until the country was electrified by the blowing up of the battleship *Maine*, in the harbor of Havana, in 1898, that the opportunity was presented for Massachusetts to demonstrate that it still possessed the private facilities to build ships for the navy. While from early times naval vessels have been launched at the government-owned Charlestown Navy Yard, no war-ship of size had been constructed at private Massachusetts yards subsequent to the Civil War period until the contracts for the torpedo boat destroyers *Lawrence* and *Macdonough* were awarded to the Fore River Engine Company, the partnership predecessor of the subsequently incorporated Fore River Shipbuilding Corporation. These awards marked the beginning of the renaissance of shipbuilding in the Bay State.

MUCH OF THE MODERN NAVY BUILT AT QUINCY

Ten years later, when the contract for the United States protected cruiser *Des Moines* was awarded to the company, and it became necessary to provide deeper water for launchings, the original plant was moved down the Fore River about two miles. Here the battleships *Rhode Island* and *New Jersey* were built, as well as the *Thomas W. Lawson*, the only seven-masted schooner ever constructed, and at that time the largest sailing vessel in the world.

Then followed, in after years, the battleship *Vermont*; five submarines for the Imperial Japanese Navy, the construction of which called for a display of ingenuity on the part of the Fore River management, inasmuch as the vessels had to be assembled in the yard, then knocked down, loaded on freight cars, shipped to the Pacific Coast, and reshipped by steamer to Japan, where they were reassembled; the scout cruisers *Salem* and *Birmingham*, which called for a speed of twenty-four knots, with coal consumption of 1.8 knots per ton, and no experience to guide the company's engineers in this field, but the development by them of a 120-inch, 7-stage Curtis turbine solved the problem, and marked a turning point not only in the history of Fore River, but in the annals of the United States Navy, and of marine construction in general. Numerous submarines, lightships, United States Army tugs, torpedo boat destroyers were built between 1905 and 1909, while the company also launched the great United States battleship *North Dakota*, up to that time the largest and most costly vessel that had been laid down in the yard.

CHARLES M. SCHWAB DECIDES IN FAVOR OF MASSACHUSETTS

In 1910, the company, in competition with the entire ship-building world, received the contract for the building of two battleships for the Argentine Republic, and it was at that period when the amount of capital necessary to handle these immense contracts was so large that the financial aid of the Bethlehem Shipbuilding Corporation was sought, that Charles M. Schwab made the important decision in favor of the Massachusetts yard. The *Rivadavia* of 39,000 dead weight tons was built at Fore River, and the contract for the *Moreno*, the second Argentine battleship, was sublet to the New York Shipbuilding Corporation.

In 1913 the Fore River Shipbuilding Company was bought by the Bethlehem Steel Corporation, and reorganized under the name of the Fore



THE OLD EAST BRAINTREE PLANT OF WHAT IS TODAY THE
BETHLEHEM SHIPBUILDING CORPORATION, LTD., QUINCY



AIRPLANE VIEW OF THE PRESENT PLANT OF THE BETHLEHEM SHIP-
BUILDING CORPORATION, LTD., QUINCY

River Shipbuilding Company, and the following year Joseph W. Powell, assistant to the president of the William Cramp and Sons Ship and Engine Company, at Philadelphia, became president of the Massachusetts corporation.

From the first, his vigorous, far-sighted management made progress and success possible on a greater scale than previously. In accordance with the Bethlehem policy, practically all the earnings were ploughed into the Quincy plant in the shape of improvements and extensions, and thus a foundation was laid upon which it was possible to build one of the most efficient ship yards in all the world, when the country went to war in 1917.

MASSACHUSETTS DELIVERS THE GOODS

When, in 1914, England wanted submarines and desired them in a hurry, Charles M. Schwab, who was in the British Isles at the time, promised to deliver ten in six months from the date of the contract. The Fore River organization was called upon to make the deliveries, and despite the fact that at the request of the United States State Department the work was performed on Canadian soil to avoid entanglements, the boats were delivered in the contract period.

15,000 MEN EMPLOYED JUST BEFORE THE WORLD WAR

It was in the same year that Samuel Wiley Wakeman, formerly associated with the New York Shipbuilding Corporation, and prior to that with the Newport News Shipbuilding and Dry Dock Company, came to the Fore River plant, where today he is the efficient general manager of the main unit, as well as general manager of the Simpson Dry Dock Plant, and of the Atlantic Works, both at East Boston. Under his able direction and with his broad vision the companies have gone forward in the intervening fourteen years to greater accomplishments than ever before. In 1916, a year before this country entered the war, nineteen contracts were accepted, and 15,000 men were employed. It was during that year that eight new torpedo destroyers for the United States Government were laid down and these larger, faster and more complicated war engines were over across and fighting for Uncle Sam within a brief twelve months. Eight submarines, built in 1916, together with three freight and tank steamers constructed for private interests, were commandeered by the Emergency Fleet Corporation after the United States entered the war in April, 1917.

Following that event contracts came thick and fast—in April, for a battle cruiser and eight more destroyers; in August, for ten, and in December, for ten more, while fifteen more submarines were ordered, and four freighters for private companies, the latter being commandeered upon completion by the Emergency Fleet Corporation.

On October 5, 1917, due to the very urgent need of destroyers to combat the German submarine menace, an additional contract for thirty-five vessels of that type was awarded the Fore River plant, with authority to construct at Squantum, Mass., a plant for the exclusive construction of destroyers, and for two subsidiary plants, one at Buffalo, N. Y., to manufacture turbines for the vessels, and one at Providence, R. I., where boilers were to be built for them.

Unlike any other shipyard in the country, all ship construction at Squantum was ordered to be carried on under cover. The plant covered

seventy acres, with ten covered building slips, six wet slips, and all the buildings necessary for a completely equipped shipyard. At one period 8,000 men were employed. Work proceeded at Squantum, Buffalo and Providence during one of the most severe winters that has visited this section of the country in decades, yet five keels were laid at Squantum on April 20, 1918, and the first boat was launched on July 18, eighty-nine days later, and delivered on November 30, 1918, just a little over a year from the time the construction of the plant was commenced,—an almost incredible feat, particularly when the fact is taken into consideration, that the site of Squantum was a swamp and an enormous amount of filling had to be done before construction could be commenced.

THE PHENOMENAL BUILDING RECORD OF 1918

The year 1918 was signalized by the signing of contracts by the Fore River concern for three merchant ships for the Emergency Fleet Corporation, three sister ships having been contracted for by the same corporation on the last day of December, 1917, while an enormous increase was made in the amount of work done at the Fore River yard, including seventeen destroyers—practically as many as were delivered by all the rest of the United States shipyards put together—which were turned over to the Government, together with ten submarines, and six merchant vessels—a total of thirty-four craft altogether, figures constituting a record for one year's work at the plant up to that period.

When, on November 5, 1918, the boiler plant at Providence and the turbine factory at Buffalo were placed directly under General Manager Wakeman's charge, he had, with the complement at the Quincy plant and the Squantum works, more than 26,000 men under him.

In 1919, contracts were signed for two scout cruisers—the *Raleigh* and *Detroit*, for four tank steamers, an ore steamer, six additional S-boats for the U. S. Government, which, with the twenty-nine destroyers delivered from the Squantum unit, the nineteen from Fore River, eight merchant vessels and thirteen submarines, also delivered from the latter plant, produced the staggering total of sixty-nine ships completed and turned over to their owners in one year.

FOUR MILES OF VESSELS BUILT BY FORE RIVER COMPANY IN 1919

Had this 1919 output been stretched from Boston to San Francisco one would have passed every 43.4 miles on the journey west a Fore River-built ship, turned out of the yard in the 365 days of that year. Had the vessels been placed stem to stern they would have extended four miles out to sea from Boston Light. Is there in existence the record of any United States shipbuilding yard comparable to the figures here presented? If so, Massachusetts is ready to pass the sceptre of shipbuilding supremacy to such a yard, but until it is shown otherwise her claim that she has produced greater tonnage and a larger number of craft in a single year within the past nine years than any other yard on the Atlantic or Pacific seems to be justified.

In the smashing of records for speed in construction the Fore River yard is unrivalled, for here was produced, from keel to delivery, in 45½ working days, the torpedo boat destroyer *Reid*, which was turned over to the U. S. Government in that period of time—a world's record as yet

unequaled, and which, in all probability, will never be duplicated elsewhere.

The *Hadnot*, a 13,500 ton tanker, 430 feet long, 56 feet in beam, was built at the plant in 1919, and at the time of her launching was 99-9/10% complete, and she took to the water with steam up, ready for her trial trip down the Fore River, and out to sea. The thirty-six torpedo boat destroyers built at the Quincy works were delivered in the remarkable time of twenty-seven months and five days, a far cry from the days of the *Macdonough*, which required forty-seven months to construct. Sixteen of the Fore River-built destroyers saw service abroad in the World War—a record that none of the other shipbuilding concerns in this country even faintly approached. The Fore River plant was the only shipbuilding unit that successfully delivered torpedo boat destroyers to the U. S. Navy Department during the actual period of the late war.

THE WISDOM OF BEING PREPARED

These records would not have been possible if the executives of the corporation had not provided beginning in 1916, a year before this country went to war, such enormous plant expansions as were represented in the steel mill erected at that time, which is 770 feet long and 188 feet wide, and where 250 tons of steel can be fabricated in a single working day. A new concrete and steel building slip, 1,000 feet long and 130 feet wide, with two 37½-ton cranes and one 50-ton crane, makes it possible to care for the building of future battleships, as well as the largest merchant vessels. In 1921 another large slip for battleship construction was built, four new slips were added for destroyers, as well as one for building merchant ships, and after the close of the war a 10,000-ton floating dock was added to take care of the necessary repairs required by the vast fleet of ships then in commission. From the date of its installation until its removal to East Boston, in December, 1924, it was in constant use and today its facilities are sought almost without interruption.

Recently the Fore River plant has utilized its facilities in the construction of merchant and ferry boats, in repairing railroad locomotives, and in caring for repairs at the Simpson Patent Dry Dock, at East Boston, now owned by the Fore River unit, which was taken over by the company in November, 1922. It was in this famous dry dock, built in 1853, at the height of the clipper ship era, that work was performed on these fleet vessels, and later in the days of the Civil War in repairing and reconditioning U. S. Naval craft. Vast improvements and extensions have been made to it and in 1925 seventeen vessels were simultaneously undergoing repairs at the yard.

On the 3rd of October, 1925, there was launched at the Fore River yard the airplane carrier *Lexington*, of 27,000 tons, 888 feet long, 105 feet in beam, and with a speed of 33 knots, driven by four turbine generators totalling 180,000 horse-power. She constitutes a combined landing field, hangar and workshop for the 72 airplanes which she carries. In her trial of speed, in November, 1928, the *Lexington* shattered all world's records for both speed and power, when she made an estimated 34.5 knots and developed 210,000 horse-power.

Recent construction has included five revenue cutters, costing \$3,-172,500; a scout cruiser, two steel colliers, two steel trawlers, and other vessels.

STILL PROGRESSING AND EXPANDING

The acquisition by the Bethlehem Corporation of the 75-year-old Atlantic Works of East Boston, in July, 1928, for something under \$1,000,000, does not tie up all the ship repair facilities of Boston Harbor under a single management, but it augurs well for improved facilities for the North Atlantic seaboard. Since the war, Bethlehem has spent some sizeable sums around East Boston, commencing with the purchase of the Simpson dry dock plant. This initial purchase was a necessity, for the Bethlehem company had its great 10,000-ton floating dry dock at the Fore River shipyard and as this was some six miles from the main ship channel, masters of large vessels were loath to bring their ships into Fore River, and the consequence was that the big dry dock was not being utilized to the fullest degree. With the acquisition of the Simpson plant a new concrete pier was erected, a traveling crane installed and the big dock was towed to Boston, where it has since been operating constantly.

The Atlantic Works handles a much smaller type of business, mostly on fishing vessels, barges, and the like. Substantial sums will eventually be spent on this plant to modernize it.

The shipping business of Boston has been increasing steadily, if slowly, and Bethlehem officials look for a continuance and this fact constituted the motivating influence in guiding the decision to purchase the Atlantic Works, where approximately 225 productive workers are employed.

As Bethlehem's Fore River yard can turn out watercraft as cheaply as any yard in the country, it stands to benefit from any governmental legislation, such as the Jones-White bill passed a few years ago. The Fore River yard is the only Bethlehem shipbuilding plant on the Atlantic, all other yards of the company having been eliminated, with the exception of ship repair plants.

A WELL-ROUNDED SHIPBUILDING ENTERPRISE

By a strange coincidence, the sale of the Atlantic Works to Bethlehem came on the seventy-fifth anniversary of the company, which was organized and incorporated in 1853. Since that time the company has been engaged in the building of ships and ship machinery. As one of the first American iron shipbuilding concerns the Atlantic Works attracted much attention. During the Civil War the plant built many Union vessels and repaired many shattered in battle, while at the time of the World War the company altered and refitted many seized German vessels to carry troops and supplies.

By a merger in 1922, the activities of the Atlantic Works and the Bertelsen and Peterson Company were concentrated at the Atlantic Works. A large steel floating drydock was installed in addition to a small floating drydock and three marine railways. The Atlantic Works has been the largest private ship repair dock in the port of Boston and has handled a large volume of work for both American and foreign shipping interests.

The Atlantic unit is now operated by the Bethlehem Corporation in conjunction with the Simpson plant, not far from the Atlantic Works, and is designated as the Boston plant—Simpson Works and Atlantic Works.

These two yards provide nine dry docks—three steel floating docks, three graving docks and three marine railways. The 10,000-ton floating

drydock and the large graving drydock are served by a 15-ton traveling crane, while the smaller docks and railways are served by lighter cranes. Ships at these yards are completely equipped for every kind of marine, miscellaneous machine and boiler work. In addition the plant has the advantage of being located within ten miles of the company's Fore River plant with its large organization and equipment, and where about 3,000 persons are employed in normal periods.

In 1928, five coast guard cutters were constructed, each vessel being 250 feet over all, 42 feet beam and 27 feet in depth. Passenger and freight vessels were built for the Pennsylvania Railroad and the New England Steamship Company, with respective lengths over all of 302½ feet, and 210 feet, and a number of trawlers were constructed for the Massachusetts Trawling Company and the R. O'Brien Company.

In 1929 work was started on a freight and passenger steamship for the New England Steamship Company, 250 feet in length, 45 feet in beam, and 16 feet in depth and on two colliers for the Wilmore Steamship Company, these vessels to be 366½ feet long, 50 feet beam, and 30¼ feet deep.

Work was also carried on at the yards that year on the scout cruiser *Northampton*, for the United States Navy, this vessel being 600 feet in length, 66 feet in beam, and 36 feet in depth.

Since its inception there have been built at the Fore River plant a total of more than 400 craft of all types and sizes, representing a total tonnage of 1,250,000 tons, of which approximately 120 vessels, of about 300,000 aggregate tons, have been delivered to the U. S. Navy, while about 400 merchant and miscellaneous ships of more than 950,000 aggregate tons have been built and launched at this famous plant.

E. G. Grace is president, Samuel W. Wakeman and H. E. Lewis vice presidents, R. E. McMath, secretary and J. P. Bender, treasurer of the corporation.

OTHER NOTABLE LOCAL INDUSTRIAL ENTERPRISES

In 1837 the Alfred Hale Rubber Company was established, its original crepe rubber sole, marketed under the name of "Rajah," still retaining its preeminent record of outstanding superiority, the process under which it is produced being unique.

Seventy-five to one hundred hands are constantly employed at the Atlantic plant, the concern being managed by David A. Cutler, as president and treasurer; A. Cushing Cutler, vice president, and William C. Cook, secretary.

THE BOSTON GEAR WORKS SALES COMPANY

Boston Standardized Gears have long been internationally famous, and at the plant of the Boston Gear Works Sales Co., at North Quincy, nearly 5,000 sizes and styles of standardized gears, speed reducers, chain drives, couplings and universal joints are manufactured, and shipped to all parts of the country, and abroad. Branch offices are maintained at Boston, New York, Philadelphia, Cleveland and Chicago, while distributing service stations are maintained in the principal industrial centers of the United States.

The company, established in 1890, is the largest manufacturer of

standardized gears, speed reducers, and chain drives in the world and ships its products to practically every country on the globe.

Large and varied stocks of Boston Standardized products are maintained at all times at the various service stations, being used in the machine tool field in the manufacture of special machinery and for power transmission in industry. An additional three-story factory building, equipped with modern manufacturing devices, and up-to-date in every way, has recently been added to the company's plant at Norfolk Downs, making possible greatly increased manufacturing facilities.

The enterprise owes its growth in large measure to the untiring activities of Frank Burgess, who became not only the pioneer in gear standardization, but one of the foremost specialists on gears in the United States. His death, in 1929, was a distinct loss to the industry.

A special feature of the three-story brick and concrete addition completed in 1929 is the spacious recreation hall, located on the third floor, where facilities are provided for motion picture exhibitions, dances and other social activities. Lectures are held for the benefit of the company's employees, and a section of the hall is devoted to reading-room purposes, and is well equipped with magazines and games.

Harry H. Kerr is president and general manager and H. C. Woodson, is vice president.

OTHER INDUSTRIES IN QUINCY

From the beginning of the portable building era, Massachusetts has led in the fabrication of this type of structure, and the Brooks-Skinner Co., Inc., capitalized for \$50,000, employs 100 hands in the manufacture of portable houses of all kinds. Harold Brooks is president and treasurer and E. C. Rosendale, secretary of the corporation.

Located at Norfolk Downs is the up-to-date factory of the S. H. Couch company, founded by Samuel H. Couch, who is president and treasurer of the corporation, with William Couch, vice president and clerk. The concern is capitalized at \$200,000, and employs upwards of 100 operatives in the manufacture of interior telephones, its products being marketed throughout the United States.

The Norfolk Paint & Varnish Co. maintains a large plant at Norfolk Downs, where paint, varnish, and enamels are produced, and where fifty operatives are employed. The concern is capitalized at \$150,000, and is managed by George E. Felton, president, A. M. MacMurray, vice president and sales manager, and Clyde H. Henderson, treasurer and vice president. The concern operates six stores, known as Norfolk Stores, in different cities of the United States.

The modern plant of the Pneumatic Scale Corporation, Ltd., located at Atlantic, houses 600 operatives engaged in the manufacture of automatic packaging, labeling and wrapping machinery, the concern being capitalized for \$1,500,000, with W. H. Doble as president, A. C. Hastings, Jr., as secretary and general manager, K. D. Doble, as treasurer and C. K. Brown as assistant treasurer.

In 1928, the Aberthaw Company, of Boston, completed an addition, 150 by 84 feet, five stories high, with a one-story shipping platform, 150 by 26 feet, to the Neponset factory of the former Hallett & Davis Piano Company, now owned by George Steck & Co., a subsidiary of the Aeolian Company, which gives the concern upwards of 275,000 square feet of man-

ufacturing space, the main factory of concrete and steel construction being more than 600 feet in length. Upwards of 500 employees are there engaged in the production of pianos. The detailed history of this concern is carried in the Chapter devoted to the industries of the City of Boston.

The Mathewson Machine Works, owned by William B. Mathewson, has revolutionized the mattress making industry by inventing, patenting and placing on the market in recent years numerous machines that have multiplied factory capacity. Other recent inventions of this concern include a brake synchrometer, for testing automobile brakes; a window shade machine, which enables manufacturers of these commodities to turn out 300 shades per hour; a cranberry picking machine, which picks a bushel of cranberries in forty-five seconds, enabling two men to do the work of twelve; and a Royway grease server, which, by a patented rotary gear pump, exerts pressure up to 700 pounds. Upwards of seventy-five operatives are employed in the plant.

The Commonwealth Thread Co., Inc., at its Wollaston plant, employs upwards of fifty operatives in the manufacture of shoe threads, William W. Macdougall being president and treasurer of the concern, which is capitalized for \$40,000. The plant is equipped with 1,000 spindles and 360 braidiers.

The Murray & Tregurtha Plant, at Atlantic, with capital of \$2,235,000, employs 150 operatives, in the manufacture of engines, J. A. Murray being president, and R. Emerson, treasurer of the corporation.

The Norfolk Iron Company, at its Norfolk Downs plant, employs fifty operatives in manufacturing ornamental iron and industrial conveyors, the corporation having a capital of \$100,000. Charles L. Gilliatt is president, and Joseph F. Kendall, secretary and treasurer.

The Peters Manufacturing Company, incorporated in 1905, employs fifty operatives at its Wollaston plant in the manufacture of shoe fabrics and findings, and of backing for satins, silks, velvets, and cotton goods, the concern having capital of \$25,000, and maintaining a Boston office at 68 Essex Street. Joseph E. Sager is president, and C. H. Gilman, secretary and treasurer.

The plant of the Tubular Rivet & Stud Co., at Wollaston, is one of the outstanding industrial units of the city, the concern being capitalized at



TUBULAR RIVET AND STUD COMPANY
(Wollaston) Quincy.

\$2,400,000, with Mellen N. Bray, president, M. E. Crocker, treasurer, and F. A. Edmands, secretary. A Boston office is maintained at 87 Lincoln Street, and the products—rivets and shoe lacing hooks—are marketed wherever footwear is made. Upwards of 800 operatives are employed, and the concern is growing fast.

The Wollaston Foundry, Inc., employs fifty in the production of grey iron castings, at its Atlantic plant. Reuben Grossman is president, Harry W. Sprague, vice president and Joseph Grossman, treasurer.

In 1895, Edward P. Bosson and Nehemiah H. Lane began a dyestuff and chemical business in Boston, and in 1903, purchased a factory at Atlantic, and since that time have engaged in the manufacture of specialties for the textile trade. In 1920, upon the death of Mr. Lane, the business was taken over by Mr. Bosson, who carries it on under the old name, the concern being capitalized for \$95,000.

Since 1849 the A. T. Stearns Lumber Company has been furnishing a complete service in woodworking. Today it constantly carries over 6,000,000 feet of lumber, has facilities for drying upwards of 200,000 feet at one time, and after this process is finished, carries from 75,000 to 90,000 feet under heat at all times.

It maintains a Boston office at 1 Sudbury Street, but all manufacturing is carried on at the Neponset plant, which enjoys wonderful harbor facilities, enabling lumber to be received and despatched on vessels. The company handles not only the ordinary types of lumber used in construction work, but it carries large stocks of the rarer varieties such as redwood, cypress, maple, mahogany, etc.

It is the distributing agent for many nationally advertised products, including paints, roofings, insulite and Morgan woodworking specialties. The company has capital of \$150,000 and employs 275 operatives. Frederick R. Moseley is president, Roland D. Stearns and A. Maynard Stearns, vice presidents, Edward S. Tenney, clerk, and Henry B. Barham, treasurer.

In 1929, Lamb & O'Connell, Inc., established a ship-building unit, at the Victory Plant, in Squantum, where complete facilities were installed for the construction of all kinds of craft and spar work. Patrick N. O'Connell is president and F. J. Lamb, treasurer and secretary.

CHAPTER XLVI

THE DIVERSIFIED PRODUCTS MADE IN THE TOWNS OF NORFOLK COUNTY ENJOY A WIDE FIELD OF DISTRIBUTION

In Avon, are located the plants of the Avon Sole Company, founded in 1913, capitalized at \$200,000, employing 175, in the manufacture of Du Flex rubber soles, and managed by Fred Drew, as president, Lester E. Packard, secretary, and Everett T. Packard, treasurer; the Gill Fisher Shoe Company, capitalized at \$20,000, employing fifty hands in the production of men's Goodyear welt shoes with Merton F. Ellis as president and treasurer, Arthur Fisher, vice president, and Joseph A. Gill, assistant treasurer; the Avon Leather Company, with capital of \$50,000, employing twenty-five in the manufacture of leather; the Bows Moccasin Company, owned by William A. Bows, with capital of \$100,000, employing forty in the production of moccasins; and The Gill Shoe Company, with capital of \$45,000, employing fifty hands in the production of men's shoes, with Wilfred A. Chaplain as president and Joseph A. Gill, as treasurer.

THE MANUFACTURES OF BELLINGHAM

In 1813 a company was incorporated in Bellingham for the manufacture of woollens, with \$40,000 capital, and the next year the Bellingham Cotton and Woolen Factory was chartered, with \$15,000 capital, and erected a plant on the Charles River, in that town.

The village of Caryville takes its name from William Cary, former owner of one of its early mills, while Rakeville derived its odd nomenclature because it was in that village that a factory was established at an early date by J. O. Wilcox where rakes and farming tools were manufactured.

At one period of its history, Bellingham had four boot and shoe factories, annually producing over 225 twelve-pair cases of footwear each week. Three of these plants were located in the center of the town, and the other in Caryville, the latter being established in 1848 by E. & W. Fairbanks. It was burned in 1874 and never rebuilt.

In Caryville is the plant of the Taft Woolen Company, employing 275 operatives in the manufacture of cashmeres and cotton warp, the concern being capitalized for \$330,000.

On this site was built, in 1813, by Joseph Fairbanks, and six others, the second textile unit to be erected in the town of Franklin, the structure being constructed of stone. It burned in 1828, but was rebuilt. In 1865 a new plant was built and a part of the old mill, with its bell tower, still stands.

In 1904 the Taft Woolen Company was incorporated, and today has

capital of \$330,000. In addition to its modern plant it owns thirty-eight tenements in Caryville.

In 1918 the corporation manufactured 2,390,914 yards of union cassimeres and satinets, and spun 43,140 pounds of silk yarn for cartridge bags for the American Army, the plant operating day and night during much of the period of the World War. The plant is equipped with twelve sets of cards, 184 looms, and 3,960 spindles, and 275 hands are employed.

Under the management of President H. M. Bullard and Treasurer A. E. Bullard it has made marked strides within recent years. A. W. Hobart is vice president, and Wendell Williams, is secretary. In 1928 a large dye house was built, 112 by 45 feet, and much new equipment has been installed.

Hon. W. W. Ollendorff operates the Bellingham Woolen Company, which was incorporated in 1912, and where upwards of 200 operatives are employed in manufacturing woollens and unions.

The present plant was acquired by that concern in 1912, from the Charles River Woolen Company, which had purchased it from the American Woolen Company, in 1900. It had been operated as a cotton mill until it was acquired by J. P., F. B., and J. G. Ray, in 1864, who owned and managed it for thirty-five years.

The company owns forty-nine tenements, a boarding house and a moving picture hall. During the World War the plant was operated night and day manufacturing silk yarns for powder bags, and many thousands of yards of its regular product, narrow cotton warp yarns, were sold to the United States Government.

It was here that the town's first cotton factory was built in 1810 by Joseph Ray of Blackstone, who had constructed many cotton mills in the Blackstone Valley for Dr. Nathaniel Miller, a graduate of Bowdoin College and of Harvard Medical School, and a group of which he was the active head.

BRAINTREE—A BUSY MANUFACTURING TOWN

About 1643 a group called the "Company Undertakers of the Iron-Works" was formed in Braintree for the purpose of establishing iron works in the Colony and 3,000 acres of land were granted on the Monatiquot River, most of which terrain was in the easterly part of Braintree.

A dam was built and the works erected and occupied for some years, but continual contentions arose between the owners and citizens of the town who were interested in the alewife and other fisheries, and eventually the disaffection was so great that one dark night a group of aggrieved local fishermen destroyed the dam and for many years thereafter no manufacturing was carried on at this water privilege.

Finally, a new dam was built about forty rods below the site of the former structure and afterwards a grist mill was erected there, followed, in 1790, by the building of another. Later, Jonah Welch began the manufacturing of chocolate on this privilege, and became celebrated for his products. About 1853 another factory was located there for the manufacture of carpets and for a short time boot and shoe lasts were produced on the site.

About 1680 John Bowditch settled in Braintree, built a dam and set up a fulling mill on the Monatiquot, the privilege remaining in the hands of the Bowditch family until about 1796.

In 1730, Col. William Hunt operated a forge in Braintree, gathering his ore from the bottom of Great Pond, by dredging, and later David Holbrook bought the privilege and it remained in the family for four generations, being used for saw and grist mill purposes.

It was in Braintree that the first glass manufacture ever carried on in Massachusetts was undertaken in the village called Germantown, not many years after the Plymouth settlement. Production was carried on without interruption until just before the Revolutionary War when the concern failed, and the plant was subsequently burned and never rebuilt.

In 1800 the manufacture of shoes was begun in Braintree by Samuel Hayden and for more than a hundred and twenty-five years this product has helped to make the town famous.

About 1823 a company was formed to take over the Monatiquot water privilege and to enlarge and improve the property and later this group sold to the Boston Flax Company, which, for thirty years, manufactured twine, linen goods, etc., removing in 1880 to Ludlow, and selling its assets in Braintree to the Jenkins Manufacturing Company.

Benjamin L. Morrison operated a woolen yarn concern on another privilege erected on the Monatiquot, and about 1816 Robert Sugden began the manufacture of woollens in what was long known as the Thayer Mill, which originally served as a saw and grist mill. About 1831, Alva Morrison succeeded Sugden.

In 1822, Oliver Ames and Elijah Howard bought an unoccupied privilege in Braintree and built shops, dwellings and other buildings necessary for the carrying on of the shovel and nail and tack business.

Warren Mansfield became a large manufacturer of cars and wagons for the military service of the government during the Civil War, and shipped many of his products to Cuba and South America.

In 1868 James T. Stevens and George D. Willis built a nail and tack factory, employing steam power and removing to Weymouth in 1871.

The Hollingsworth & Whitney Paper Co. owned two valuable water privileges in Braintree, known as the upper and lower mills, the latter having been used for sawmill purposes until about 1810, and later for grist mill products. At what time the upper mill privilege was first occupied is unknown, but as long ago as 1764 it was described as being the site of a saw and grist mill and until about 1820 it was employed for various manufacturing purposes, the Blake & Revere Copper Foundry Co. taking it over about the beginning of the third decade of the nineteenth century for the production of bells and other copper work.

About 1832 John M., and Lyman Hollingsworth, of Milton, bought both privileges and began the manufacture of paper and it was while they were carrying on business here that they discovered and perfected, in 1842, the process of making manila paper from old rope, which it was learned could be so fabricated as to be practically impervious to water. The concern became known as Hollingsworth & Whitney. When Messrs. John M., and Lyman Hollingsworth left Braintree, they were succeeded in business by their brother, Ellis A. Hollingsworth.

At South Braintree is located the plant of the Stedman Products Company, capitalized at \$800,000, engaged in the manufacture of naturalized flooring, a product that is generally used in hospitals, banks, business structures and other buildings throughout the United States. Here is a concern that has grown by leaps and bounds during the past decade, now

employing upwards of 350 workers. H. O. Phillips is president, George W. Bailey, secretary, and James Irving Finnie, treasurer of the corporation.

At East Braintree are the East Braintree Bleachery and Dye Works, established in 1914, and incorporated in 1928, owned by Henry McCusker, and employing 100 hands, the concern being engaged in bleaching processes and in treating and finishing book cloth and bleaching and finishing shoe linings. The corporation has capital of \$91,000.

The Braintree Shoe Company employs 400 operatives at its South Braintree plant in the manufacture of shoes; the C. B. Slater Company, with capital of \$150,000 employs 250 workers in its South Braintree shoe factory, Charles B. Slater being president and treasurer, and Earl S. Greenlaw, secretary; the United Paper Company, with capital of \$100,000, employs twenty-five hands in the production of waterproof wrapping paper at its East Braintree plant, and, in 1928, placed on the market its mulch paper, designed to be used between the rows of growing crops to eliminate weeds, to concentrate heat, to aid moisture at the roots, and to stimulate chemical reactions by bacteria in the soil. Charles Cranford is president, F. E. Donovan, vice president and secretary, and John E. Prouty, treasurer.

The firm of T. E. Kilroy & Co. is engaged in cotton waste production, and has its Boston office at 222 Summer Street.

The Bostock Shoe Company, Inc., with capital of \$45,000, employs sixty operatives in the production of women's shoes, at its South Braintree plant. W. F. Bostock is president, T. F. Bostock, secretary, and John H. Sullivan, treasurer.

The Central Shoe Manufacturing Company has capital of \$35,000, and produces women's shoes, Jacob A. Izenstatt being president, secretary and treasurer of the corporation.

The J. M. Connell Shoe Company, Inc., employs 275 operatives in the manufacture of sport shoes and has capital of \$50,000. J. M. Connell is president and John P. Crowe, treasurer and secretary.

The Old Colony Gas Company has capital of \$709,000 and employs fifty men and women. E. M. Farnsworth is president, E. M. Farnsworth, vice president and treasurer, and Howard B. Hall, secretary.

THE ADVENT OF THE CITIES SERVICE REFINING CO.

On July 16, 1923, the Cities Service Refining Company, of Massachusetts, was incorporated, and acquired the real estate and other property of the Massachusetts Oil Refining Company, and erected at East Braintree a complete modern oil refinery, which has a present daily refining capacity of 10,000 barrels, and which today operates a group of twenty-six tank and service stations in Massachusetts and Connecticut. These are all a part of the great international corporation, capitalized for \$600,000,000, with total assets in excess of \$800,000,000, and owning more than 100 operating public utility and petroleum subsidiaries stretching from the Atlantic to the Pacific coasts, and from Mexico into Southern Canada—an enterprise conceived and fostered by Henry L. Doherty, student, engineer, inventor, philosopher, financier, and leader in three of the most important branches of national business—gas, electric power and petroleum.

The Massachusetts subsidiary has capital of \$4,182,975, now employs

upwards of 250 workers at the East Braintree plant, and is the town's fastest growing industry.

In Braintree there are twenty manufacturing establishments, which, in 1927, used stock and materials valued at \$10,139,428, gave employment to 1,503 workers to whom were paid \$1,729,253 in wages, and manufactured commodities valued at \$13,738,163.

BROOKLINE'S MANUFACTURES

The Jersey Cloth Mills, in Brookline, manufacture jersey cloth, astrachans and woolen, worsted and rayon light-weight knitted fabrics. E. L. Barrows, and R. J. Logan constitute the partnership.

The Boston Clip and Tag Company employs twenty-five operatives in the manufacture of laundry tags, A. S. Nye, being president, F. D. Fuller, secretary, and W. L. Hall, treasurer.

William M. Beach is the owner of The Bromfield Publishers, specializing in greeting cards, and employs 150 operatives.

The Columbia Tire and Top Company, owned by Richard A. Brine, manufactures automobile tops, and employs twenty hands.

George W. McNear is engaged in the manufacture of automobile bodies and employs upwards of seventy-five operatives.

The firm of E. S. Ritchie & Sons, now owned by A. Eliot Ritchie, employs twenty-five hands in the manufacture of nautical instruments.

The Riverdale Press, capitalized for \$40,000, employs thirty hands in its large printing establishment. A. L. Spencer is president, James F. Lyons, secretary, and Carleton E. Waters, treasurer.

Walter's Inc., with capital of \$60,000, employs fifty hands in the manufacture of confectionery. J. F. Flaherty is president, M. A. Walsh, secretary, and Walter L. Flaherty, treasurer.

THE INDUSTRIES OF CANTON

In 1788, Jonathan Leonard and Adams Kinsley formed a partnership, and erected buildings at South Canton, where they engaged in iron manufacture. Five years later they erected a slitting mill, and in the four succeeding years cut and rolled 1,000 tons of iron, mainly imported from Russia, and between 1790 and 1800 turned out annually over 200 millsaws and 300 dozen scythes.

The first welding of steel was accomplished at Canton, in 1792, by the use of borax, but frequently bog-iron ore, finely powdered, was sprinkled on the steel when it had reached a white heat, and at that temperature formed a glossy cement which would unite the bars.

The first local manufacturing of steel was accomplished by Leonard & Kinsley five years later, and in 1809, the latter erected a steel furnace, and the former established one four years afterwards.

On January 6, 1812, Enoch Leonard was granted a patent for making steel from pig iron.

Early in the nineteenth century the Leonard & Kinsley plant began the production of firearms, and during the war of 1812 turned out thousands of muskets for the U. S. Army. It manufactured car axles and car wheels, with the advent of the railroads, and in 1845 operated day and night forces, producing forty car wheels every twenty-four hours. The following year it made 1,800 car wheels for one western railroad alone.

In 1854 it was incorporated, with \$200,000 capital, as the Kinsley Iron

& Machine Co. and employed as high as 225 men, the plant covering an acre and a half of ground.

In 1801, Paul Revere came to Canton from Boston, bought the property formerly used as the government powder mills, and laid the foundation of the Revere Copper Company, engaging in the manufacture of rolled copper bolts, spikes and nails, in addition to casting bells and cannon. It was here he produced the copper bolts for the *Constitution*, and in 1812 he sent copper to Philadelphia in teams, drawn by oxen. In 1834 the Revere Copper Company erected a rolling mill, and, in 1850, a large brick mill for making yellow sheathing metal for the bottoms of ships. In 1862 the concern made eighty 12-pound brass cannon for the U. S. Government, each of which weighed on an average of 1,230 pounds, and cost about \$600 apiece. The old Revere unit was later merged in the present-day Taunton-New Bedford Copper Company.

The first cotton factory in Massachusetts operated by machinery, which was built in Canton, in 1803, on the east branch of the Neponset River by James Beaumont, Abel Fisher and Lemuel Bailey, who, on May 14, of that year, formed the firm of James Beaumont & Co., with capital of \$2,400, is treated at length in another chapter of this work.

On August 24, 1818, D. Dana and A. Holmead, of Canton, were granted a patent on lathes for turning gun stocks.

THE RISE OF G. H. MANSFIELD & CO., INC.

Still standing adjacent to a small water power site, in Canton, and now used as the dwelling of several families, is the original factory established by William Mansfield, in 1821, and in which he pioneered in experiments on fishing lines. Here, too, the business passed from the control of the founder to his three sons, George H., Horace H., and Frederick W., and again, in turn, in 1909, to Frank W. Mansfield, son of Frederick, who built a three-story brick plant, with other buildings, and, in 1926, a large three-story annex was added to the main structure. The enlargement afforded space for new machinery and for equipment to throw the raw silk, which process previously had been carried on in outside factories. A completely equipped dye-house was built, and a printing department added. When William Mansfield began the manufacture of threads and twines almost 110 years ago, a few braided fish lines were being imported from England, but owing to their varying lengths, and the uncertainty of deliveries, he decided to engage in this type of production, and the first braided silk lines produced in America were manufactured by him. For several years a dozen braiding machines took care of the business, but today G. H. Mansfield & Co., Inc., employ 100 machines in the manufacture of braided silk lines alone.

In 1865-66 the company produced the first enameled silk line made in this country. Previous to the time the concern began the manufacture of braided silk lines, only twisted lines were available. In 1909, upon the death of the last of the sons of the founder, the business passed to Frank W., son of Frederick W. Mansfield, who is now president and general manager, being associated with his sons, F. Winslow Mansfield, Jr., as treasurer and George M. Mansfield as secretary. The corporation has a capital of \$200,000.

In 1824 the Neponset Cotton Manufacturing Company, was formed, in

Canton, and erected a stone building, which became known as the Neponset Factory, and in which satinets were manufactured.

In 1839 the Eureka Silk Manufacturing Company began the manufacture of twist silks on the water privilege first used in 1821 by G. H. Mansfield & Co. in the production of cotton thread.

As early as 1843 spinning rings for cotton mills were made in Canton, and other small industries of the town during the nineteenth century included paper box plants, and printing press and excavator machinery concerns.

Messenger & Brother operated a factory in the town, in the fifties, where they produced sewing, sadlers' and embroidery twist, and fringe and floss silks, maintaining a Boston distributing depot at 19 Milk Street.

"RISING SUN" MORSE

But in all the town's industrial history probably no local product has attained such world wide fame as the "Rising Sun Stove Polish," conceived and manufactured by Hon. Elijah A. Morse, who, in 1864, upon the completion of honorable service in the Union Army, returned to Canton and began the production of his stove polish in a small room of a dwelling. Morse was one of the Massachusetts industrialists who had faith in his product and he personally traveled twenty-two states in the Union in order to introduce his commodity to the trade. Ultimately it became as standard as flour in every grocery store in the land, and as the years went by Mr. Morse built numerous factory units in Canton, the largest structure being of brick, four stories in height, 225 by 25 feet. In 1881, in one day, four carloads of Rising Sun Stove Polish left the plant, weighing 57,500 pounds, or nearly 29 tons, and made up of 165,000 single packages of his product, each four inches in length, which had they been placed in line, end to end and touching each other would have extended ten and a half miles.

Almost with his first dollar of profit Mr. Morse became one of the greatest exponents of outdoor and other forms of advertising in the United States, and for years one could not walk, or ride anywhere in the country without beholding on bill boards, barns, fences, and structures of various kinds, as well as on the rocks by the wayside, the magic words, "Use Rising Sun Stove Polish," a message which vied for more than a generation, with children crying for Castoria, Carter's Little Liver Pills, and Ayer's Sarsaparilla.

The product made Canton famous and sent its inventor and producer to Congress.

In the sixties, Draper & Sumner began the manufacture of woolen goods, in Canton, purchasing the water power privilege at South Canton, and the Morse Machine Shops, and finally carrying on three enterprises,—the Canton Woolen Mill, the Everett Mill, and the original plant.

THE NORFOLK JAPANNERIES, INC.

In 1884, the late Charles B. Rathbun became superintendent and general manager of the R. Ward Leather Company of Newark, N. J., the oldest manufacturer of patent leather in this country. Later he removed to Bellville, N. J., where he established a factory of his own, and there japanned the first chrome patent leather ever made. Previous to that time, practically all patent leather manufactured for shoe purposes was

finished on the flesh side of the skin or hide, and carried a series of from six to eight coats of boiled linseed oil. This chrome process opened a new field, and Mr. Rathbun, visualizing its possibilities, began a series of experiments using the grain side of the skin, later disposing of his own business to Walker-Oakley Company of Chicago, with which concern he became identified. While with that house he invented a new process of chrome tanning, and started experimenting with a gun cotton film in place of linseed oil, and upon returning to the east he worked for some time with a large manufacturer of pyroxyline solution, made from gun cotton, perfected a method that was applied to the manufacture of patent leather, and became the inventor of the process. It was at the Ward factory, in Newark, that Mr. Rathbun put into effect his experiments in finishing patent leather by the gun cotton process, and, in 1905, he went to Europe, where he introduced and sold the grain method of making patent leather to Carl Freudenberg & Co. Returning to this country, he again engaged in the manufacture of patent leather at Nutley, N. J., and later consolidating his efforts in the interests of one of his customers, at Little Falls, N. Y., where he and his son, W. F. Rathbun, produced all the patent leather for the Barnet Leather Company of that city, for about nine years. He then removed to Canton Junction, where he began business in his own name, later changing to a corporation, known as C. B. Rathbun, Inc. Following his death, on April 1, 1924, the concern was consolidated with the Norfolk Japanneries, Inc., which plant today is the largest independent japanning unit in the United States, having a capacity of upwards of 5,500 sides of leather per day. Here every known kind of leather is turned into the patent type, about 250 hands being employed in the plant, which has a floor area of more than 105,000 square feet, each unit being a separate factory in itself, the natural contour of the 20 $\frac{1}{4}$ acres of land lending itself to the use of the gravity system, thus eliminating all pumping of materials.

In 1920, following the trend of automobile manufacturers in finishing cars, Mr. Rathbun experimented along similar lines on leather and in the fall of 1925, the first apparently satisfactory gun cotton spray finish was made. Time proving some defects, after a series of continued experiments, the present successful finish was offered to the trade in 1927, and the outlook for a complete revolution in the patent leather industry on highest grade patent leather points toward this finish finally being adopted.

Among other lines, the Thayer-Foss Company's famous line of paramount patent leathers is japanned in this plant, as well as the well-known line of lacquer finishes known to the trade as "Silko".

The present officers of the Norfolk Japanneries, Inc., are William F. Rathbun, president and general manager, Lloyd J. Thayer, treasurer, Leslie G. Rathbun, superintendent and Walter L. Heinemann, assistant superintendent. The corporation has capital of \$99,000.

The Narragansett Suspender & Webbing Company operated in Canton up to 1884 when the plant was destroyed by fire.

THE INDUSTRIES OF TODAY

But the Canton industries of the long ago were not nearly as extensive as those of the present era.

The Draper Brothers Company, established in 1856, and incorporated in 1899, with capital of \$1,000,000, today employs 200 operatives in the

manufacture of merino fancy knitted goods, knitted linings for rubber shoes and paper-makers' felts. Alfred E. Draper is president, John H. Draper, secretary and Roger Williams, treasurer of this fast growing corporation, which operates eleven sets of cards, 27 broad looms, 5,590 spindles and does its own dyeing and finishing.

The Crow Blacking Company with capital of \$250,000, and owned by George H. Capen, employs 150 operatives in the manufacture of leather blackings and dressings, inks and adhesives, and patent leather, in its modern plant there.

The Neponset Woolen Mills, incorporated in 1921, with capital of \$300,000, employ upwards of 150 operatives, in the manufacture of casket cloth, and dress goods, the concern being managed by William J. Finn, president, H. M. Mullin, secretary and W. Arthur Aveyard, treasurer. The concern operates ten sets of cards, ninety-three broad looms, 3,504 woolen spindles and complete dyeing and finishing departments.

The Samson Electric Company one of the town's larger industries is capitalized for \$200,000, and employs upwards of 100 operatives in the production of electrical specialties, which find a wide market. The concern was established in 1883 and produces the Samson fire signal and telephone systems, annunciators, batteries, radio apparatus and marine motor ignition. The development of the radio has greatly enlarged the Samson line, and a branch plant is now operated in Watertown. C. C. Colby is president and treasurer, and Stanley H. Prince, secretary, of the corporation which maintains a Boston office at 146 Summer Street.

The American Fireworks Company of Massachusetts, with capital of \$100,000, employs sixty operatives in the production of fireworks, Henry L. Rapp being secretary and treasurer, with Antonio Gioiosa, president, and Joseph Gioiosa, vice president of the corporation.

The Karded Products Company capitalized at \$100,000, employs forty operatives in the production of carded yarns, H. G. Mitchell being president and treasurer, and S. R. H. Davis, secretary of the corporation, which operates a factory at Taunton.

The Knitted Padding Company, incorporated in 1919, with capital of \$625,000, employs fifty operatives in the manufacture of knitted padding, H. G. Mitchell being president and treasurer and B. D. Barker, secretary and assistant treasurer of the corporation.

The Plymouth Rubber Company established in 1896, and incorporated in 1922, with capital of \$200,000, employs 1,000 operatives in the manufacture of rubber goods, the processes including the rubberizing of silks, satins, cottons, auto top fabrics, electric tapes and hospital sheetings. Ira M. Hamilburg is president, Walter H. Bieringer, vice president, and M. J. Hamilburg, treasurer.

The J. J. White Paper Company was incorporated in 1919, and has run its plant at capacity in the intervening years, enlargements to the original buildings and extra machinery having been installed to care for its sales of waterproof wrapping and packing papers for the export and domestic trade, marketed under the trade-brand, "Packrite", and for its waterproof building papers, its "Eternal" brand being fabricated from 100% sulphate kraft paper. John J. White is president and treasurer. The corporation has capital of \$25,000.

In May, 1925, the Addison-Leslie Company was incorporated to manufacture and market plastic wood and allied products, first locating at New-

ton, but removing in December of that year to Canton where a plant was leased, which has since been purchased.

The product is a putty-like material which is packed in airtight cans and hardens on exposure to the air to a material having the appearance and qualities of wood, save that it has no grain. It is sold generally for domestic use and to carpenters and painters, and it finds wide industrial application in automobile body and boat building and furniture manufacturing. The commodity is marketed in every state in the Union, and the volume of production is rapidly expanding, due in part to a national advertising campaign which has been very successful.

C. A. Depuy is president, William T. Jenney, vice president, and Leslie Soule, treasurer and secretary, of the corporation.

The Yorkshire Mills, Inc., which were incorporated in 1924, are engaged in reworking wools. Walter Waring is president, Oliver Holmes, vice president and Joseph Waring, treasurer.

The Springdale Finishing Company, Inc., established in 1903, and incorporated in 1922, with capital of \$250,000, is engaged in dyeing, napping and finishing cotton piece goods, ducks, twills, drills, and sheetings for the clothing, rubber, awning and tent trades. It employs 115 operatives.

Dr. Parker Holt Babywear, Inc., was incorporated in 1923, for the manufacture of infants and children's underwear. P. A. Esten is treasurer of the concern.

In 1928, the Tobe Deutschmann Corporation acquired an idle plant in Canton, containing 92,000 square feet of floor space, located in six buildings on Washington Street, where every facility exists to produce in large volume.

It is here that the famous Tobe condensers for every radio use are manufactured, as well as filterettes for a myriad of uses, such as sewing and washing machines, refrigerators, electric fans, motors, home lighting plants, generators, chargers, oil burners, sign flashers, etc. Two hundred hands are employed. Tobe C. Deutschmann is president and treasurer, Perry S. Graffam, secretary, and W. K. Fleming, vice president.

"MOTHER BROOK"—DEDHAM'S SOURCE OF WATER POWER

In 1681, a fulling mill was built in Dedham, by Messrs. James Draper and Jonathan Fairbanks, located on Mother Brook, an artificial canal, three and a half miles long, which carried a considerable portion of the waters of the Charles River into the Neponset, and, which furnished water power to numerous factories along its route. The canal was constructed for power and factory purposes in 1639 by the enterprise of citizens of the town, and divided honors with Mill Brook, in Watertown, as being the oldest canal in the United States.

The execution of a public work of this character, in the very infancy of the settlement, is striking evidence of the energy and capacity of the earlier citizens of the town.

John Elderkin built a water mill on the artificial stream and in 1664 a new corn mill was erected by Daniel Pond and Ezra Morse. In 1658-59, Eleazer Lusher and Joshua Fisher built a sawmill on the Neponset, near the Cedar Swamp and when in 1681, Messrs. Fairbanks and Draper sought permission to build their fulling mill on East Brook, Nathaniel Whiting

was associated with them by order of the town, his descendants holding the privilege down to the beginning of the nineteenth century.

In 1807 Samuel Lowder, Jonathan Avery, Reuben Guild, Calvin Guild, Pliny Brigham, William Howe, and others, incorporated the Norfolk Cotton Manufactory, for the production of cotton goods, and a large wooden factory was built, and later the concern enlarged its corporate powers so as to engage in the manufacture of wool, and produced satinets. The company prospered until after the war of 1812 and in 1819 its property was sold at auction for \$12,500. In 1827, the Dedham Manufacturing Company which occupied the plant installed machinery, having capacity to produce 6,000 yards of cotton cloth a week, and employed seventy hands. The same year, Frederick A. Taft was manufacturing 4,000 yards of fine cotton cloth each week at his factory.

The first and second water privileges on Mother Brook were later owned by Benjamin Bussey who erected woolen mills on both, with machine shops, dyehouses and dwellings, and was a successful manufacturer, selling the property in 1853 to J. Wiley Edmands, and later Edmands & Colby, the Maverick Woolen Company and the Merchants Woolen Company operated the plants.

In 1803, George Bird purchased the mill property located on the fourth water privilege and succeeded Herman Mann in the manufacture of paper, and after the plant was burned in 1809, Bird rebuilt. A second mill on the same privilege was erected for the manufacture of wire, but in 1814 operations were discontinued and Bird purchased the entire privilege, including the land and buildings.

In 1823 machinery from the plant of the Norfolk Manufacturing Company was installed and a new corporation was formed under that name, and seven years later the property which had been leased from Bird for ten years was purchased by it. The company continued in business until 1863 when Thomas Barrows bought the assets, enlarged the mill and engaged in woolen production until 1872 when he sold to the Merchants Woolen Company.

In 1814 the Dedham Manufacturing Company was incorporated and erected the fifth dam on Mother Brook, in the Readville district (later Hyde Park) and erected a cotton factory.

Silas Mason, of Dedham, invented a carding machine, in 1819, "expressly calculated for the manufacture of wool hats," which produced the headgear in its conical formation in one operation. The invention marked the transition of the art of the hatmaker from that of a manual trade to a process of the machine age, and the device produced by Mason was evolved even before the year generally attributed as that of the initial appearance of machinery in the manufacture of hats—namely 1820.

In the thirties Dedham had a silk manufactory, established by Jonathan H. Cobb and in 1837 there were produced in the town 7,135 pairs of boots and 18,722 pairs of shoes, valued at \$32,483; silk goods of the value of \$10,000; straw bonnets valued at \$20,000; chairs and furniture valued at \$21,050 and marbled paper and enameled cards of the value of \$18,000.

John Goulding was given two patents on February 16, 1829, and two others on June 11 and July 21, on machines for manufacturing wool.

On May 11, 1832, Frederick A. Taft was granted a patent on a process of manufacturing paper for covering buildings.

In 1835, the New England Silk Company was established in the town, with \$50,000 capital, and the initial equipment included sixteen sewing silk machines.

For 290 years Mill Creek, or "Mother Brook" has been the power source of the principal manufacturing interests of Dedham, and is today of inestimable value to the town in fostering its industries.

The five mill-dam privileges served during the earlier years as sites for grist and sawmills, fulling mills, a leather plant, the first local cotton factory, and for paper, wire, woolen and other mills. The first privilege in point of location from the Charles River, and the second oldest in occupancy, is today utilized by the Dedham Finishing Company, which is a twentieth century enterprise, established in 1915, by William H. Gray, who, since the close of the World War, has extensively developed the plant where bleaching, finishing, and dyeing of the lighter grades of cotton and artificial silk goods are carried on, the concern having a weekly capacity of 900,000 yards of fabric, being capitalized at \$330,000 and employing upwards of 200 operatives.

Since 1639 "Mother Brook" has been providing power for manufacturing establishments and today all of the ancient privileges are used—the first by the Dedham Finishing Company; the next, at Bussey Street, by the Hodges Finishing Company; the third and fourth, now combined into one, by the Dedham Mills, of the M. J. Whittall Associates; the fifth, by the Readville Cotton Mill, and the last by B. B. & R. Knight, of Providence, R. I., which that firm has used since 1879.

The Boston Lightning Rod Company employs thirty operatives in producing lightning rods, maintaining Boston and New York sales offices. Henry L. Willard is president, G. Carlisle Willard, Jr., vice president, and George C. Willard, secretary and treasurer of the corporation.

The Hodges Finishing Company incorporated in 1919, with capital of \$100,000, employs 150 operatives in bleaching and dyeing, William H. Hodges being president, Walter E. Hodges, vice president, Frederick H. Hodges, secretary and Frank B. Hodges, treasurer, of the corporation. The concern has capacity of 100,000 yards per day.

The M. J. Whittall Associates, of Worcester, manufactures woolen and worsted yarns at its Dedham plant, which is equipped with eight sets of woolen cards, eight sets of worsted cards, six worsted combs, 2,800 woolen, 4,652 worsted and 1,044 twist spindles, and a complete dyeing department.

In 1929, William A. Robertson, manager and the largest stockholder in the Dedham Pottery Company and the last of his family to follow the trade of potter, died in Dedham, and for a time it was feared the secret of the manufacture of "crackle ware," a type of production discovered by his father, and widely imitated by other potters, was lost.

Many generations ago Mr. Robertson's forefathers were potters in England, and his great-grandfather established a pottery in New Jersey, which still bears his name, while other ancestors set up potteries in Chelsea, East Boston and Morristown, Pa. His father, William C. Robertson, was proprietor of the Chelsea Pottery Company until his death, in 1908, at which time the son, William A., took over the management of the concern, and shortly after removed the plant to Dedham, and changed the name of the company to the Dedham Pottery Company.

During his lifetime, the latter Robertson produced vases which won prizes at the Paris, Buffalo, San Francisco and St. Louis expositions, while articles manufactured by him were sought by collectors all over the world. Mrs. John L. Gardner, the internationally famous art connoisseur, had a large collection of Mr. Robertson's products, and specimens have been on exhibition at the Boston Art Museum, and elsewhere.

A few months after his death, an official announcement was made by Ralph W. Redman, who succeeded Mr. Robertson as manager, that the latter's son, J. Milton Robertson, had been appointed superintendent, and that to him was entrusted by the father the priceless secret of producing the crackled finish which has made the ware, with its familiar "blue rabbit" border design, famous the world over. Until the younger Mr. Robertson had an opportunity for experimentation, he was not sure that he could work the formula out in practice, but after a month of tests following his father's death the concern found it possible to produce the same type of ware as was previously made.

Henry E. Wetherbee is president, and William A. Robertson, treasurer and manager.

DOVER'S FAMOUS PORTABLE HOUSES

As early as 1796 Dover had slitting- and sawmills, and in 1815 a rolling mill was established there by Boston, Medfield and Dover capitalists, being the first unit of its kind to operate in this part of the United States with one water wheel, it having been the universal practice previously to employ two undershot wheels. The concern operated for eight or ten years.

Hill & Sons built a mill in which they manufactured sheathing paper and at one period shoe manufacturing was carried on in a small way in the town.

The E. F. Hodgson Company with capital of \$60,000, employs upwards of one hundred and twenty-five men in the manufacture of portable houses, the concern being one of the pioneers in this field. Ernest F. Hodgson is president, James Chickering, vice president, and M. C. Lyons, treasurer, and the company maintains a Boston office at 1108-1110 Commonwealth Avenue, and a magnificent exhibit of its products on the Boston-New York turnpike, at Sudbury.

THE FOXBORO COMPANY

In the darkest hour of the Revolutionary struggle the manufacturing unit which in after years was known as the Foxboro Foundry & Machine Company came into being for the purpose of casting cannon, shot and shells for the use of the Continental Army. For a long period the concern manufactured firearms and made a specialty of castings for straw goods manufacturers.

At one period of its existence the town of Foxboro possessed the largest straw hat factory in the world,—the Union Straw Works. It has been the center of many and varied industrial concerns, including felt hat, leather board, box, stove, boiler, hollow ware, basket, boot and shoe, broom, wool scouring and foundry units, and at one period the Rotary Shuttle Sewing Machine was manufactured there, but no more world-famous unit has operated within its borders than the present-day Foxboro Company.

The growth of this concern, the producer of industrial indicating,



THE FOXBORO COMPANY, FOXBORO, BEFORE ADDI-
TION WAS MADE IN 1927



THE FOXBORO COMPANY, FOXBORO, 1928

recording and controlling instruments, shows what can be done in Massachusetts with an idea, when capital, genius and progressive methods are applied to it.

The phenomenal record of the company, less than twenty years old, constitutes an epic of modern business. Combining high quality of products with progressive sales and advertising policies, the concern has achieved a world-wide reputation and has made the name of Foxboro famous. The development during the last ten years has been marked and scarcely a business day passes that the company does not receive orders from each of the forty-eight states in the Union and frequently from as high as twenty-six foreign countries. In 1927 the increase in orders made it imperative for the company to enlarge its factory and office space by 67%, and it now employs 300 men and women, being one of the larger industries of Norfolk County, and capitalized for \$1,500,000. E. H. Bristol is president, and B. B. Bristol, secretary and treasurer of the corporation.

The town is still famous as the center of hat production, the firm of Dodkin Brothers, composed of Alfred T., Fred and Herbert Dodkin, employing fifty operatives in the manufacture of ladies hats, and children's felt and straw hats, while the Edwin S. Pickert Company capitalized for \$70,500, employs 150 operatives, and maintains a branch factory at Haverhill. Edwin S. Pickert is president and treasurer, and A. R. Pickert, secretary of the corporation. The Kimball Hat Company, Inc., manufactures men's hats. W. S. Kimball is president, M. A. Fitzgerald, treasurer, and R. C. Magrath, secretary.

The New England Road Machinery Company maintains its shipping plant at Foxboro, the concern being capitalized for \$200,000, and employs forty in the production of road machinery. W. S. Railsback is president and treasurer, and E. A. Foote, secretary of the corporation.

FRANKLIN—FAMOUS ALIKE FOR STRAW BONNETS AND TEXTILES

Franklin's first grist mill was established in 1685 and twenty-eight years later one was built in the North Precinct.

At the beginning of the nineteenth century the town became famous as the center of the straw braid and bonnet business, which had its local origin through an odd circumstance. Miss Sally Richmond, a student at an academy in Wrentham, in the summer of 1799 taught the art of braiding straw to the women with whom she boarded, and out of that adventure there grew a new industry in Franklin and Wrentham, which in a few years, became the leading trade in that section of Norfolk County.

For several years the work was carried on in a small way in the homes by the female members of families, many of whom soon became adept in the art, and acted as instructors of others who were anxious to earn "pin money."

The first straw hat factory in Franklin, worthy of the name, was erected in 1812, by Asa and Davis Thayer, and soon afterwards Asa Rockwood & Son built another.

By 1869 there were seven local manufacturers of straw goods and 1,000,000 hats and bonnets were shipped from the town, that year. It was not until 1872 that the hydraulic press was introduced into the plants and that same year seventy-two sewing machines were installed in the local factories, all the sewing previously having been done by hand.

By 1884 the business was carried on by two local concerns, one of which employed 225 women in the factory and 250 in the homes of Franklin. The previous year 19,000 cases, each containing four dozen hats, or a total of 912,000, were shipped from the town.

Shoes, rubber mats, wooden boxes and canned goods constituted a prominent part in the town's manufactures during the last century and, in 1879, an ambitious attempt was made by a group of local capitalists to put Franklin on the map as the center of beet sugar manufacture. A company was organized that year, with \$133,000 capital, and for over a year the experiment was carried on, but it early developed that it could not be converted into a successful undertaking due to the fact that local and vicinity farmers were unable to produce an adequate supply of beets at a price which would give them a profit and at the same time permit the corporation to compete in prices with their sugar beet competitors of the West, and eventually the corporation passed out of existence.

Up to that period no fertile minds had been able to evolve a panacea such as the McNary-Haugen bill of the present era, and it is doubtful whether a thrifty New England farmer would have sanctioned so evil a plan as an equalization fee had such a nostrum been devised at the time.

THE INDUSTRIAL ACHIEVEMENTS OF THE RAY FAMILY

Many are the towns and cities in Massachusetts whose present day importance may be traced exclusively to the influences exerted by the members of a single family who, following the scriptural injunction, have made two blades of grass grow where but one grew before.

No more conspicuous example of what one family group may do in behalf of a municipality to which it transplants itself is found anywhere in the Commonwealth than in Franklin. The Ray family moved to that part of the town, known as Unionville, in 1839, and there the three brothers James P., Francis B., and Joseph G. Ray founded the textile business of the community, which after nearly a century of existence still constitutes the major industry of Franklin.

They were the sons of Colonel Joseph Ray, a native of West Wrentham, who for many years was a member of the firm of Paine & Ray, which built many of the large textile factories in Woonsocket, R. I., and adjacent towns in the Blackstone Valley. Colonel Ray established a cotton mill in Franklin, but met with reverses, and after a heroic struggle was forced to retire. His eldest son, James P., began his manufacturing career at the age of seventeen years, with a total cash capital of seven dollars, when, in 1837, he built a small carding mill in the village of City Mills, now the home of one of the large plants of the American Felt Company. At the outset, he produced cotton bats, but soon the industry expanded and the spinning of yarns and the manufacture of cotton wicking and twine were added. He removed the business to Unionville, and in 1844 the second son of Col. Ray, Francis B., was admitted to partnership, and the firm of J. P., & F. B. Ray was formed.

Purchasing the Makepeace Mills, in the village of Unionville, the manufacture of cotton bagging was added to the other products, and in 1851, Col. Ray's youngest son, Joseph G., who had begun his industrial career at the tender age of seven years, when he worked nights and mornings out of school hours in the batting mill owned by his brother, and who had entered the employ of J. P., and F. B. Ray, when nineteen years of

age, at a wage of \$450 per year, was admitted to the firm, which became known as Ray Brothers. It was in that year that they installed the first rag picker and produced the first wool shoddy made in this part of the United States.

In 1860, Francis B. Ray retired from the firm, and erected the plant of the Ray Fabric Company at Unionville, where he utilized old material and wool substitutes in the production of woolen fabrics, and where he also became the first manufacturer of knit goods in Franklin. .

The two brothers, James P., and Joseph G. Ray continued to operate the firm, which was known as J. P., and J. G. Ray, and for almost 100 years the manufacturing interests of Franklin and neighboring towns carried on by the three Rays, and their descendants, have grown to large proportions and have included the production of almost every kind of textile commodities.

They were either entirely responsible for, or majority stockholders, in the operation of the following plants, in Franklin: the Franklin Cotton Company, manufacturing cotton twine, bagging, clothes line and other cotton products, now operated by the Brookdale Mills; the Ray Fabric Mills, in Unionville, which made at different times felts, knit linings, blankets and all kinds of horse clothing, and now the plant of the Whitney Worsted Company; the Ray Cotton Company, in Unionville, which is still operated by Joseph G. Ray, a grandson of the original James P. Ray; the Ray Woolen Company, in Franklin, which was sold to the American Woolen Company when that concern was formed and has since been operated by them as the Ray Mills; the McKenzie Mills, in Franklin, which are at present owned and operated as a woolen mill by Harry T. Hayward; the plant at City Mills, near Franklin, erected in 1881, by Messrs. J. P., and J. G. Ray, and originally capitalized for \$96,000, which is at present a part of the American Felt Company. The Rays also operated the Norfolk Woolen Company, manufacturers of wool shoddy at Norfolk; the Charles River Woolen Company, at North Bellingham, now the Bellingham Woolen Company. The Rays also owned or were heavily interested in woolen and cotton mills in Medway, and Caryville, in this state and Pascoag, R. I., and Putnam, Conn., operating the Putnam Manufacturing Company in the latter place.

They owned the Massachusetts division and the controlling interest in the Rhode Island division of the old Franklin & Valley Falls R. R. Company, were the sole owners of the Woonsocket & Pascoag R. R. Company and the Franklin National Bank, of Franklin, as well as the Ballou, Bartlett, Jenckesville, and Lyman Mills in Woonsocket, R. I., and they controlled a majority of the stock of the Citizens' National Bank of that city.

When the American Woolen Company was formed, Joseph G. Ray was elected as its first vice president, and he was also the first president of the American Felt Company.

The three Ray brothers were succeeded in their various enterprises by William F. Ray, son of Francis B., and by Edgar B. Ray, son of James P. Ray.

In 1882, William F. Ray established the plant, which five years later became the Norfolk Woolen Company and which today employs seventy-five hands. He owned or controlled, during the period of his active business life, mills at Unionville, in Franklin, and in Norfolk, Bellingham, and Mendon, the total output of wool waste, wool extracts, and shoddy

of these units averaging about 650 tons per annum, all of which were consumed by manufacturers of woolen goods.

Several of these business enterprises are carried on by Charles A. R. Ray, grandson of Francis B. Ray, and Joseph G. Ray, grandson of James P. Ray. Without question the family is responsible to a great extent for the development of the textile industry in Franklin, and surrounding towns. Ever since 1839 the succeeding generations have played a prominent part in town affairs, holding numerous local offices, and being active in state and national politics, as well as in civic and community movements.

THE PRESENT-DAY MANUFACTURING PICTURE

The Appleton Rubber Company which but a few years ago suffered a disastrous fire that wiped out its plant, has risen Phenix-like from the ruins and is now housed in one of the most modern rubber factories in the state, where are employed fifty operatives, H. O. Phillips being president, P. O. Lawton, treasurer and general manager of the concern, which is engaged in producing reclaimed rubber, rubber compounds, friction and rubber tape.

The Brookdale Mills, Inc., which were incorporated in 1921, and of which Samuel Colt is president and C. G. Wells, secretary and treasurer, is engaged in the production of upholstery and tapestry goods, cotton, cotton and silk, jute specialties, and bed spreads, and are equipped with 105 looms. The concern employs 175 operatives.

In 1911 the Clark-Cutler-McDermott Company began the manufacture of horse blankets, but, like many another progressive Massachusetts concern sensed the market far enough in advance to discontinue the original line, and adapt itself to the trend, turning to the production of pad-dings for the automobile trade, and to carpet and rug cushions, acoustical, saddlery, tailoring, and pipe covering felts, kersey linings, and shoe and slipper padding.

The concern now employs seventy-five operatives, and its officers are Walter A. Clark, treasurer, Thomas S. McDermott, president, and Clinton S. Clark, vice president. It maintains a general sales office at 76-78 Summer Street, Boston, and is capitalized for \$250,000.

The Clover Worsted Mills, incorporated in 1917, with capital of \$150,000, employ 125 hands in the manufacture of piece dye worsted fabrics, Herbert Lawton being president, and M. Smith, treasurer and secretary.

The Franklin Weaving Company, incorporated in 1921, of which C. E. Bailey is president and J. M. Levenson, treasurer, employs 100 hands in the production of marquisesettes and rayon taffetas, plisse cloth, cotton and jute cretonnes, and novelty cloth.

The Franklin Yarn Company, manufactures woolen and merino yarns for the weaving and knitting trade, and was incorporated under the laws of Maine in 1902, and in Massachusetts, in 1918.

Fred P. Chapman and Jacob F. Geb, formerly with the Ray Woolen Company, together with New York capitalists, purchased the plant, equipped with four set of cards, from Adelbert D. Thayer, in 1902, following which the present concrete building was erected and machinery added from time to time, until now it consists of fourteen set of cards, 6,480 woolen spindles and 280 twister spindles.

Recently a complete dye-house equipment was added for stock and

skein dyeing and scouring. The company has capital of \$126,000 and employs 150 operatives.

Fred P. Chapman is president, Jacob F. Geb, treasurer, Boyd P. Chapman, vice president and Harry J. Geb, superintendent.

Harry T. Hayward bought the J. M. McKenzie mill in 1892, and in January, 1927, he incorporated the H. T. Hayward Company, of which A. E. Donald is now manager. The plant has been enlarged many times since its purchase by Mr. Hayward, and in 1928 an extensive addition was built and modern machinery was installed in all departments until it stands today as one of the best equipped woolen mills, in Massachusetts. Three hundred hands are employed in the manufacture of cotton-warp woolens. Mr. Hayward is also prominently identified with many other worsted and woolen concerns in Massachusetts. The Franklin plant has capital of \$400,000, is equipped with ten sets of cards, 150 looms, 3,616 spindles, and a complete dyeing and finishing department. One hundred and seventy-five hands are employed.

The Norfolk Woolen Company of which Charles A. R. Ray is president, and Hon. Bradley M. Rockwood is treasurer, incorporated in 1887, is capitalized for \$90,000 and employs 100 operatives in producing reworked wool, this being one of the numerous Ray family concerns.

The Ray Cotton Company, with capital of \$200,000, employs 150 hands in producing cotton waste, Joseph G. Ray, being president and treasurer, F. E. Woodward, vice president and Fred L. Cook assistant treasurer and secretary.

This concern was established by Edgar Ray in 1835, and was incorporated as the Ray Cotton Company in 1916. The main plant is in Hebronville, in the City of Attleboro, and the sales offices are located in Boston. A branch plant is operated in Woonsocket, R. I., where cotton is carded and willow cotton waste is produced. The concern handles all the cotton waste of upwards of thirty mills, located in various parts of New England, which material is brought to the various plants by the company's own auto trucks, where it is sorted, graded and baled ready for shipment to customers in many sections of the United States and Europe. The concern maintains a branch office in Augusta, Ga., which handles the waste of some twenty-five southern mills.

The Whitney Worsted Company, incorporated in 1922, and capitalized for \$135,000, employs one hundred operatives in the production of men's wear worsted suitings, Herbert Lawton being president, Stanley H. Lawton, vice president and secretary, and Charles D. Whitney, treasurer.

In 1927, the Thomson-National Press Company of Long Island, N. Y., purchased the plant formerly owned and occupied by the Golding Press Division of the American Type Founders Company, and removed its machinery from its Long Island factory to Franklin, employing at the outset from 100 to 125 hands in the manufacture of presses and cutters. The purchase included a modern four story building, and all machinery and tools of the Golding Press Division. A small addition was subsequently built to accommodate the installation of some of the machinery removed from Long Island. The corporation has capital of \$800,000. S. H. Rosenberg is president and treasurer, and Basil M. Paesons, secretary.

The American Felt Company operates the Franklin Mills in the production of high-grade woolen felting, the plant being equipped with complete

dyeing, bleaching and finishing departments, six sets of cards and employing 100 operatives. W. F. Bennett is agent.

The Ray Mills division of the American Woolen Company employs 250 hands in the local plant, where overcoatings and top-coatings are produced. This mill was formerly owned by the Ray Woolen Company, and is one of the town's largest plants.

The Locke-Ray-Shine Box Toe Company, Inc., has capital of \$50,000 and employs fifty operatives in the manufacture of supplies for shoe producers. E. H. H. Ray is president, A. A. Tenney, secretary, and Walter H. Heaton, treasurer.

One of the units of the F. S. Payne Company, of Cambridge, is operated in Franklin, the corporation having acquired The Central Iron Foundry a few years ago, at which plant it produces its castings for elevators.

W. D. Mann & Co., owned by James V. Mann, is engaged in the production of wool and merino shoddy and the dyeing of raw stock cotton and wool.

The Unionville Woolen Mill, owned by R. W. Foss and J. R. Duggan carries on the manufacture of reworked wool.

The Alpine Woolen Company, owned by John Ketover, is engaged in the manufacture of wool shoddies.

Franklin has a number of other industries including the Estate of William C. Clark, manufacturing woolen and felt machinery; DeBaggis & D'Errico Company, owned by Agostino DeBaggis and Rocco D'Errico, dealing in bakery products; and L. W. Milliken & Sons, owned by W. C. and W. B. Milliken, manufacturing duck, ticking and leather supplies for looms; the Murdock & Get Company, of which Ernest Parmenter is president and Palmer A. Woodward is treasurer, producing bobbin holders.

THE PRESENT DAY INDUSTRIES OF HOLBROOK

From the beginnings of the town of Holbrook the manufacture of boots and shoes has been its leading industry. Fifty years ago the total value of all local manufactures was \$2,007,700, and with the exception of \$6,000, represented by other types of production, all of this came from footwear.

Ephraim Lincoln probably was the pioneer boot and shoe manufacturer of the town, beginning his operations about 1800.

Eighty years later there were sixteen shoe factories in Holbrook, affording employment to 950 men and 202 women, to whom were paid in wages, that year, a total of \$445,000. The local concerns in this line of trade were capitalized at \$487,600, used stock and materials in 1880 costing \$1,360,652 and turned out products valued at \$2,007,700.

In 1912 there was established in Roxbury what, in the intervening eighteen years has become the largest manufacturer of disinfectants in America. J. H. McGuire began the business that year in his own name, later incorporating it as the Sterling Company. Two years afterwards, C. C. Baird became associated with him, and, in 1914, Baird & McGuire, Inc., was incorporated, and the concern removed to Holbrook, where a plant, with five acres of land and a sidetrack, provide the production and distribution facilities. As substantially fifty per cent of the business at Holbrook is export, the company decided in 1924 to establish a branch plant in the middle west, which they located at St. Louis. The coal tar products, sheep dip, creosote oil, and cresylic acid manufactured by the concern are produced for the wholesale and distributing trade only. The

company owns and controls a fleet of tank cars of from 8,000 to 10,000 gallons each, operates a large fleet of auto trucks, and is capitalized for \$50,000. C. C. Baird is president and he, with H. W. Cole, Ella H. McGuire and M. G. Baird, constitute the board of directors.

The Brockton Shoe Manufacturing Company, Inc., capitalized at \$288,000, employing 650 hands, is a recent addition to Holbrook's industrial concerns and the advent of the corporation means much to the town. C. H. O'Neill is president and E. F. O'Neill, treasurer of the concern. In 1929 it was awarded a United States Government contract to supply the Navy with 140,000 pairs of low shoes, at a cost of \$505,400.

J. E. and M. C. McLaughlin, and J. E. Hooker compose the firm of McLaughlin Brothers & Co., which is engaged in the production of children's shoes.

THE INDUSTRIES OF MEDFIELD

The hat industry of Medfield runs back to 1801, when Johnson Mason and George Ellis, partners in a general store, accepted in exchange for goods, straw braid which they sent out to be sewed into bonnets by the women in the vicinity. The straw employed was that of rye, cut when in the blossom and prepared by scalding and bleaching.

In 1810, a few women were hired to make bonnets by David Fairbanks, in his tavern, the products being carried to Providence by ox teams, and thence to the New York market by boat. The manufacture of straw hats was taken up in 1845 by Warren Chenery who opened a small establishment.

The present day Edwin V. Mitchell Company was founded in 1851, when Walter Janes employed thirty women to make hats in the old Unitarian parsonage which stood on the site of the factory.

In 1851, Daniel D. Curtis, a young man from Mercer, Me., entered the employ of Mr. Janes, and five years later was admitted as the junior partner of the firm of Janes and Curtis. Upon the death of Mr. Janes, in 1865, the business was carried on by the survivor, and at that period the concern had become so successful that it was annually shipping 3,000 cases of hats, and had doubled the capacity of the plant by erecting a large addition.

Mr. Curtis conducted the business alone until 1871, when he formed a partnership with Haskell A. Searle and Granville F. Dailey, of New York City, who attended to the sales, and the purchasing of braid, while Mr. Curtis gave his attention to the manufacturing.

At this time hats were sewed in the homes, and many stock carts were driven through Medfield, and the adjoining towns, to deliver braid and thread to the women and to return with the hand-sewn hats. At the factory they were sized and finished by hand-flatting, for in these pioneer days sewing machines, dies, and press machines were unknown. Less than a dozen patterns of straw braid were known, and the only three colors—black, brown and navy—were made from logwood.

Next came the sewing machine, which was indeed a revelation, the first being made by Bosworth. A ring of braid was made to fit the circumference of the brim and the hat was sewed toward the tip, which was put in by hand. Then the stamping machine appeared, equipped with dies of iron or lead which were used for shaping and finishing the hats, in place of hand-flatting. In the early seventies, a fourth color, a

drab or gray, made from logwood, was considered a wonderful discovery. The hydraulic press machine was another great stride, for this gave the hat an even hydraulic pressure over its entire surface.

On October 3, 1876, the entire factory was wiped out by fire, and the present plant, erected on the same site, was ready for occupancy January 1, 1877.

It was at that period that Edwin V. Mitchell entered the employ of Mr. Curtis, and when the latter died in 1885, Mr. Mitchell became a partner in the firm of Searle, Dailey & Co.

The next great invention was the Wilcox & Gibbs sewing machine of English manufacture, which was first experimented with in this country in the Medfield factory. Many of the ablest mechanics in the local factory doubted the practicability of the new device, as the operator made the tip first and sewed toward the outer edge of the hat, a process exactly the reverse of the method previously employed.

However, the expectations of the inventors were surpassed. The development of this style of machine has performed a service to the hat industry, that may be compared to that rendered agriculture by the harvesting machines.

In 1898 a new boiler house was built, in which five boilers of one hundred horse-power each, with the necessary pumps and equipment, were installed.

In 1899 the name of the concern was changed to Edwin V. Mitchell & Co., but the New York office retained the designation of Searle, Dailey & Co. For one year after Mr. Searle's death, in 1907, Messrs. Dailey and Mitchell conducted the business as a partnership, when Searle, Dailey & Co., became the selling agents, and the factory was incorporated under the name of the Edwin V. Mitchell Company.

The present officers of the corporation are Granville F. Dailey, president, and Edwin S. Mitchell, treasurer. The concern has capital of \$450,000.

The present plant contains two and one-half acres of floor space, and 325 operatives are employed. Rest and lunch rooms are maintained for the women employees. The company makes its own corrugated and wooden boxes by special machinery, and the entire factory is operated by motor drives, the detached power plant being equipped with two units of the latest type direct-driven generators, which furnish electric service for light and power.

A modern concrete dye-house and bleachery, a large storage warehouse, a private gas plant, coal sheds and trestle, with storage capacity of 3,000 tons, and minor buildings, complete this up-to-date plant.

The plant of the American Brick Company is located in Medfield, the main office of the concern being in Boston. This corporation has capital of \$500,000. George D. Dutton is president, and Arnold A. Roberts, Jr., treasurer.

MEDWAY'S EARLIER AND LATER MANUFACTURES

As early as 1659 Medway had a corn mill, another being set up in 1680, and others followed with rapidity.

Not until 1807 was the first cotton factory established there, in a building 60 by 30 feet, two stories high, which was equipped with 880 spindles. The concern was incorporated two years later as the Medway

Cotton Manufactory. The plant was burned in 1811, but was immediately rebuilt and stood for seventy years thereafter. The original site was later occupied by the Sanford New Mill.

On August 31, 1820, Duncan Wright was granted a patent on drying cloth by steam rollers, and on December 7 of the same year, Jonathan Fish was awarded patents on five different improvements on the double speeder for spinning cotton, and one for a combination of these in the double speeder.

In the early 1820's lace manufacturing by machinery was carried on in Medway.

In 1823, Dean Walker & Co., were manufacturing lace on power machines having a daily capacity of fifty yards of the commodity, five inches wide, which sold for two dollars a yard. The loom employed was of unique construction, and was produced from mental notes made of a machine observed in England. The warp was wound on twenty-six spools, each with a compound motion, the spools, with 1230 shuttles, traversing side by side within a space of fifty-six inches, and being kept in motion by one operator by means of two handles, three treadles, and two thumb pieces, producing a web of plain lace 56 inches in width. By drawing single threads, the web was divided into twenty-six pieces, from one and a half to five inches wide, which were finished with ornamental needle work, by female hands.

In 1837 the various cotton factories of Medway had 2,400 spindles, and turned out annually 500,000 yards of cloth, valued at \$50,000, while 76,000 yards of woolen fabrics were locally woven that year, valued at \$72,000.

For fifty years prior to 1837 the manufacture of boots and shoes was a prominent industry in the town, some three hundred operatives being employed in the various shops that year. The production amounted to 40,000 pairs of boots and 100,000 pairs of shoes, the aggregate value of which was \$150,000. By 1884 about four hundred hands were employed in the local shoe factories, and the annual value of the products had risen to \$1,000,000.

About 1800 Medway took its place alongside other Norfolk County and vicinity towns in the manufacture of straw braid and bonnets, and by 1837 the local production of the latter was 30,000 annually, valued at \$50,000, and in 1874 straw braid bonnets manufactured locally were valued at \$200,000.

As early as 1815 Colonel George Holbrook established a church bell factory at East Medway, and during the last century clocks, church organs, organ pipes, awls, wooden boxes, mallets, brick, etc., were manufactured in the town.

The Fabyan Woolen Company, capitalized for \$600,000, employs 175 hands in the production of shirtings, flannels and cloakings, Fred Wildey being president and Charles H. Meyers, secretary and treasurer of the corporation.

The present Medway plant of this concern is located on the site of the original factory, built in 1806 by the Medway Cotton Manufacturing Company and the water privilege is the oldest but one on the Charles River, having been used substantially without interruption for 230 years, the first dam having been erected as early as 1700, and probably before.

In the Suffolk County Registry of Deeds are recorded two transactions,

one executed in 1703, deeding one-half of the quarter part of the grist mill, on the Charles River, from Benjamin Clark to his son, Edward, and the other, in 1706, from Benjamin Clark et als to John Whiting, of Wrentham, miller, "all right, title, and interest in a grist mill and lands, with irons, stones, dam, housing, implements in and about the mill," placing his son, Nathaniel, in charge of the mill who operated it until his death, in 1779, and then by the latter's son and sons-in-law until 1806 when the Treadway Cloth Manufacturing Company took over the property. In 1881 the present main building at the Fabyan Woolen Company's plant was erected for Samuel Hodgson, and in 1904 the Fayban Woolen Company acquired the factory and when the dam was washed out some years ago a new concrete structure was thrown across the river at the plant.

The Medway Shoe Manufacturing Corporation, whose plant is at West Medway, employs fifty in the manufacture of shoes, the concern being managed by Nicholas Caneles, president, Peter B. Hart, vice president, and Robert A. O'Donnell, treasurer.

The Stone Mill Company, with capital of \$55,000, is engaged in the manufacture of woolen goods, employs fifty operatives, and is managed by James Hodgson, president; A. L. Saunders, secretary, and Robert J. Hodgson, treasurer.

The plant of the United Awl & Needle Company, a subsidiary of the United Shoe Machinery Corporation, is located at West Medway, and affords employment to seventy-five operatives, in the production of shoe shop specialties.

The William H. Wilkinson Company, at West Medway, with capital of \$20,000, employs forty operatives in the manufacture of oiling devices, William H. Wilkinson being president and treasurer, and Robert J. Hodgson, assistant treasurer, of the corporation.

A. B. Holden employs twenty operatives in his wooden box factory at Caryville, which stands on Hopping Brook on the site of an old grist mill. A box factory had existed on the spot for several generations before Mr. Holden acquired the plant in 1908.

THE ROMANCE OF THE CLICQUOT CLUB COMPANY

Few more romantic stories of the development of a big industry, whose name is now a household word in more than fifty countries in the world is found in the annals of Massachusetts manufactures of the twentieth century than in the development of the Clicquot Club Company.

In 1885, the late Lansing Millis, a retired railroad executive of means, forsook the crowded marts of business for a delightful residential spot near Boston, and, locating in the town of Millis, established a gentleman's farm, stocked it with thoroughbreds, and dedicated it to the cultivation and propagation of the finest that could be produced in the line of cattle, horses, and crops.

Of a benevolent type, he produced and packed many farm delicacies for his friends, among the number excellent cider, made from his over supply of apples, and to insure the keeping qualities he installed a bottling machine, which was kept busy but a few weeks in the year. Fond of ginger ale, he conceived the idea of putting the machine to more constant use. In his possession was a formula he was anxious to test, and during the months when his employees were not engaged in bottling cider they set the machine to a new task. Neither Mr. Millis, nor his farm hands,

realized at the time that they were starting one of the largest industries of its kind in the world. In point of palatability, ginger ale was then, as it is still, so temptingly wholesome and refreshing as to commend itself as a beverage, and at that period the brands favored by the comparatively few were imported in small bottles and cost so much that only a limited number of persons indulged in the luxury their contents afforded.

At the outset, Mr. Millis's first thought was to discover a good spring, with an unfailing supply of water since that natural resource was the chief constituent of ginger ale. His search led to a fine spring, in Millis, whence flowed clear, sparkling water, in unfailingly generous quantity, and which upon analysis was found to be so pure and of such delicious quality as to be considered incomparable by all who tasted it.

Confining the early distribution to his circle of acquaintances, most of whom were members of the Clicquot Club this name was applied to the beverage. Gradually the local and vicinity public heard of the product and Mr. Millis provided customers with the beverage and established wagon deliveries in nearby towns. After his death, production was carried on in a desultory way, but it was not until 1901 that a corporation was formed to take over the old company, and the name Clicquot Club Company was chosen. The control of the new company was in the hands of Horace A. Kimball of Providence, R. I., a former woolen manufacturer, whose son, H. Earle Kimball, is now president and treasurer. At the same time Charles W. Sanford became secretary of the company and with H. A. Kimball, was responsible for the policies and management of the company from 1901 up to the death of the latter in 1924. In that year, Mr. Kimball was succeeded by W. H. Parker, formerly of the Carnation Milk Products Company.

From the original little bottling machine, bought to aid in cider making, to a vast plant, from which flows a steady stream of 300,000 bottles of ginger ale every working day; from a friendly private endeavor designed to provide a delicious drink for one's friends to a company whose products today enjoy an international reputation, and whose advertising is seen wherever one travels, is indeed a far cry in these days.

The enormous output is handled by over 4,000 jobbers in as many cities and towns throughout the United States, and to insure these dealers against delay or disappointment in filling orders, there is a storage room with capacity for holding over 1,500,000 cases of the bottled beverage.

Not only is Clicquot Club ginger ale sold in every state in the Union, but it finds its way into the far corners of the earth, and is being shipped to over fifty foreign countries. Hundreds of thousands of cases travel by rail from shore to shore, or by water through the Panama Canal, across the Great Lakes via the ports of the Atlantic seaboard and the Gulf of Mexico, and in fact all over the world.

Years of fruitful experience, of profitable study and analysis, of successful accomplishment, and of human interests have gone to make up this seemingly magical production and popularity of a product which a little more than a quarter of a century ago was unknown.

The story of the Clicquot Club Company is but added evidence that Massachusetts is far from dead industrially. At the beginning of this century the town of Millis was scarcely known beyond the confines of Norfolk County. Today, the very mention of its name in more than two score countries abroad, and in every city, town, village and hamlet in



WHERE THE CLICQUOT CLUB COMPANY
BEGAN BUSINESS IN 1890



AERIAL VIEW OF THE CLICQUOT CLUB COMPANY, MILLIS, 1927

this nation instantly suggests the habitat of a beverage known to almost every man, woman and child living in civilized nations.

Lansing Millis builded better than he knew when he turned his bottling machine to the production of ginger ale, for out of his little company has grown a \$2,000,000 corporation, which affords constant employment to 250 men and women. The present officers of the corporation are H. Earle Kimball, president and treasurer, Chester D. Johnstone, vice president, and William H. Parker, Jr., secretary.

From Millis, on July 16, 1927, there went in one solid train load of forty refrigerator cars owned by the company, 400,000 bottles, or 800,000 glasses of ginger ale, the consignment not being broken until arrival at Chicago, seventy-two hours after leaving the factory. The loading of the final cases was accomplished by the famous Clicquot Club Eskimos, known throughout the country to all radio fans. The last placed on board was a special case of ginger ale sent by Governor Fuller to the Mayor of Chicago as a measure of appreciation of the tremendous progress made by this Massachusetts concern in its field.

In 1893 Joseph M. Herman acquired the J. W. Thompson plant, and established the Joseph M. Herman Shoe Company, which now employs 600 operatives in the manufacture of shoes for the United States Army, and men's footwear of many types, the concern being capitalized for \$591,000, E. M. Fettes being president, F. J. O'Donnell, secretary and treasurer.

The Safepack Mills, with capital of \$600,000, employ seventy-five operatives in the manufacture of water-proof paper, asphalt shingles and prepared roofing. George F. Kerr being president and treasurer, and Harry W. Powers, secretary of the corporation, which maintains a New York sales office at 46 Great Jones Street. This concern has enjoyed a steady growth since its inception.

The Safepack brand of water-proof paper manufactured by the concern is probably one of the best known types in the country, and is widely distributed. Safepack shingles are advertised by the concern to the extent of \$50,000 a year, and the company is one of the two producers of asphalt shingles located in New England, the other being Bird & Son, Inc., of Walpole, which produces these commodities at its Norwood plant. The Safepack Mills own ten acres of land in Millis, and the many buildings in which production is carried on are not only extensive, but are thoroughly up-to-date in layout and equipment. The officers have always stressed quality, rather than volume of production.

In 1929, the corporation was acquired by the Ruberoid Corporation, but it will continue to operate under its original corporate name as a unit of the parent concern, and with no change in personnel.

As early as 1634 the waters of the Neponset River turned the first mill stone in America, at Milton, for the grinding of corn, this being the original application in this country of water power to this process.

In the same town, the first American paper mill was operated in 1675, and here, too, the manufacture of chocolate was begun in 1764.

SOME OF THE MANY INVENTIONS OF BENJAMIN CREHORE, OF MILTON

Benjamin Crehore, a native of Milton, where he was born in 1778, was the manufacturer of the first bass-viol ever fabricated in this country. Many of his instruments are still in existence in various parts of

New England, and are said to possess tones that are better than many imported bass-voils.

Crehore was one of the most versatile men of his era, and following the production of bass-voils, he was called upon to repair an imported piano forte, whose parts he analyzed, while mastering its mechanism and movements, and then began to manufacture these instruments, his first piano being turned out in his Milton shop, in 1800, said to be the first ever made in America. Lewis Babcock, a Milton boy, was one of his apprentices in piano manufacture, and William and Adam Bent, of that town were in his employ, these three continuing the local production of pianos for a few years after 1800, and at a period when the genius of Crehore aspired after some new enterprises, including the invention and construction of power cotton looms.

In 1811, Lewis Babcock, with William Bent, began the manufacture of pianos in a small factory on Washington Street in Boston, and when the latter removed to Philadelphia, Thomas Appleton and Alpheus Babcock, a younger brother of Lewis, formed the firm of Babcock, Appleton & Babcock. In the spring of 1812 this firm hired two large rooms in the house recently owned and occupied by Lemuel W. Babcock, on Canton Avenue, Milton, for a workshop in making pianos, the removal to the town being but temporary while a building was being erected for them on Milk, near the corner of Washington Street, in Boston. The pianos made in Milton were taken to the city to receive finishing and tuning by Alpheus Babcock, and were kept there on sale.

Upon the death of Lewis Babcock, in 1814, at the age of thirty-eight years, the business was removed to Boston, and Charles and Edna Hayt were admitted to the firm. In 1817 the company failed, and Alpheus Babcock went to Philadelphia.

Capt. John Mackey, of Weston, a master mariner, on a return voyage from Marseilles, was induced to bring to this country a Frenchman, who had been a piano manufacturer; and, becoming deeply interested in the man he acquired the suspended business at the old stand on Milk Street, and employed Joshua Stephens, who had been in the employ of Hayt, Babcock & Appleton, as foreman.

On the death of Stephens, Alpheus Babcock returned from Philadelphia, and assumed charge of the business for Captain Mackey.

Jonas Chickering, who came to Boston in 1818, and who worked at cabinet-making with James Parker, on Milk Street, was employed four years later by John Osborn, who learned the piano business of Hayt, Babcock & Appleton. Captain Mackey moved to Washington Street, where Chickering and Mackey joined in the manufacture and sale of pianos.

About this time Alpheus Babcock left Boston to enter the employ of John G. Clem in Philadelphia, and while there he received a diploma for the manufacture of the best piano made in America. He was soon recalled to the service of his former employers, and continued with the firm until his death, in 1842.

He was a man of much talent, constantly inventing and introducing improvements in all parts of the instruments. For many years he maintained a private room, to which no stranger was admitted, and where he conducted his experiments. Doubtless his patient study, mechanical ingenuity and skill did much to establish the early reputation which the Chickering pianos have so long sustained.

At the close of the War of 1812, Dean Weymouth, a young man who had lost his left leg in the service of his country, came to Milton from the South, for the purpose of obtaining an education especially suited to the new conditions of life that had come to him from the misfortunes of war.

Benjamin Crehore, wishing to befriend Weymouth, and always eager for a trial of his ingenuity and skill, conceived the idea of making a wooden leg for the soldier-student, with joints at the knee, at the ankle, and in the foot, suitably adjusted by straps and elastic force. After many modifications he succeeded in fitting out an artificial limb, which worked naturally and easily and which was supposed to be the first successful experiment of the kind ever made in this country.

TWO HUNDRED YEARS OF PAPER-MAKING

In 1928 was observed the bi-centennial of the beginning of the first paper mill established in the eastern part of the state, and it is significant that three companies operating in the industry today are associated with the start of paper manufacturing in the mill at Milton, set up on the banks of the Neponset River, in 1728, in which year the General Court of the Province of Massachusetts Bay granted a monopoly to five men who were given "the sole privilege of making paper in the province for ten years."

In 1801, Mark Hollingsworth leased from Jeremiah Smith Boies, or his heirs, the original Milton mill, the latter being a grandson of Jeremiah Smith, who, in 1737, began manufacturing in that plant. Through the succession of interests in the Smith and Boies family, Mark Hollingsworth is a connecting link between the beginning in 1728 and the industry 200 years later.

Hollingsworth's lease of a mill in 1801 was the first step in the establishment of the Tileston & Hollingsworth Company, of Boston, which today is perhaps unique as being a paper manufacturing enterprise within the borders of one of the country's great cities, its plant at Hyde Park employing 175 operatives. Two other well-known paper enterprises of New England today trace their history to the entrance of Mark Hollingsworth into the business. The Hollingsworth & Vose Company, capitalized at \$600,000, operating plants in East Walpole and West Groton, where they employ 600 operatives, and the Hollingsworth & Whitney Company, of 100 Milk Street, Boston, with plants at Waterville, Gardiner and Madison, Maine, which corporation originally operated in Watertown, in this state, were organized by his descendants.

The start of the paper mill at Milton was mildly prophetic of the alarms which were to disturb the then industrial giant of the world—Great Britain.

The first paper mill in the country was the Rittenhouse, established in Germantown, Pa., in 1690, but evidently it did not constitute enough of a threat to stir misgivings among British paper merchants and exporters.

But when the Milton enterprise was started—the second of its kind in this country—the story of which is treated in an early chapter of this work, some rumblings of alarm were heard overseas.

MILTON IS FAMOUS THE WORLD OVER FOR ITS WATER CRACKERS

A century ago men of Massachusetts, engaged in business, saw no occasion to line the walls of their offices with maps, charts and diagrams

showing where their sales agents were located, and explaining why Portland, Oregon, bought less of their commodities than Portland, Maine. They manufactured only what they felt they could sell and they dispatched it to the customers who ordered it. Some produced their goods, slung them into saddle bags, or in the rear of a cart, hitched up the old mare and started out over the countryside looking for potential customers.

Josiah Bent, of Milton, was one of these business men of the long ago. He raised a goodly number of daughters, and in his home was a large Dutch oven. He mused that these buxom daughters might aid him in his plans, as like many another, he did not care for farming. The urge of industrialism was in him. The materials for success seemed to be at hand. All around him was the forest, furnishing an inexhaustible supply of faggots, that could be cut for fuel. Down at the village was a grist mill, turning out good, wholesome flour. The springs of Milton furnished a constant supply of excellent cold water. The old Dutch oven was idle most of the time. He decided he would rather be a baker and a peddler, than a tiller of the soil, and accordingly one fine day he harnessed the old gray mare, swung himself up on her back, and allowed her to amble down to the grist mill at the falls. He invested in some bags of white, powdery flour capable of making good bread or biscuits, and singing as he turned the horse's head homeward he rode back to his home on the hillside.

On arrival he went to the spring and pulled up a bucket of clear, cold water. With the assistance of his wife and daughters he mixed the flour and water until it was dough and there wasn't a lump remaining. No other ingredients were required by him—no salt, no shortening—nothing else. Bent then built a fire from the faggots he had cut on the edge of his farm and he waited until the old Dutch oven was piping hot inside. When the temperature reached a point where it was so hot that in the middle of the cavern he could not hold his hand without danger of burning it, but if his digits were held near the floor it appeared just warm, he cleaned out the ashes, and deposited the little round pellets of dough he had fashioned, closed the door and left the product to bake.

When the crackers were cooked he took them out, allowed them to cool, filled up two sacks with his product, harnessed up the old mare, set out upon a visit to all the houses in the vicinity that denoted prosperity, sold all his commodities, and returned to his home to bake more.

That was the beginning of the famous Bent cold water crackers which today are known and used throughout the civilized world.

Not long ago two clubmen, one an Englishman, the other an American, were finishing their dinner. Pushing back a plate, holding crumbs of crackers and Roquefort cheese, the Englishman praised the excellence of the former. They were Bent's, said the American. The Englishman said he had heard of them before and had eaten them in London and Sydney. And then the American explained that even today the crackers were fashioned in precisely the same way they were more than a century ago in the little house on the hillside by Josiah Bent and his daughters, who were unafraid of work.

In a comparatively small building, in Milton, today, save for the fact that there are eight ovens, where there was but one when Josiah Bent began business, and that the dough is now mixed and rolled by machinery, and that the crackers are cut and stamped by machine, the process is precisely the same as it was a hundred years ago. The men build their fires of

hardwood faggots every working hour of the day on the floor of the ovens and after a temperature of 900 degrees Fahrenheit is attained the doors are opened, the ashes raked out, the ovens cleaned with long-handled mops, and the mixed dough, rolled, cut, and stamped is placed on flat wooden shovels and set on the floor of the ovens by which time the temperature has receded to 600 degrees, at which figure it is held for forty-five minutes, the length of time required to cook an oven full of the crackers.

They go from Milton to every state in the Union and as far away as South Africa and Alaska where they are eaten by natives and foreigners. Lineal descendants of Josiah Bent still keep up the manufacture. The name and the process have withstood a century of competition and radical changes in the mode of living, and while the ovens are larger than in the time of the founder, the factory of more extent than the old homestead and the modern office replete with roll top desks, typewriters, adding machines, and a map on the wall with red pins showing the distributing centers, one almost imagines seeing the ghost of Josiah Bent's old gray mare tied outside the building and the spectre of old Josiah himself watching the burning of the faggots. P. L. Draper is president and John C. Gerald, secretary and treasurer of the G. H. Bent Company, which has capital of \$50,000.

Isaac Sanderson, of Milton, received a patent on April 18, 1829, covering a cylindrical paper-making machine and in 1838 he was granted a patent covering a discovery in the manufacture of brown paper from a then new material called sandgrass.

Cosgrove Bros., Inc., of which Joseph F. Cosgrove is president and treasurer, today operates a plant at East Milton, where women's underwear and bathrobes are manufactured, and the National Biscuit Company has one of its ten Massachusetts factories in the town. The Brooks-Skinner Company, Inc., of Quincy maintains an attractive exhibit of its portable houses in Milton.

THE WILLIAM CARTER CO. WAS FOUNDED A LITTLE MORE THAN THREE
SCORE YEARS AGO

Among the underwear manufacturers in this country The William Carter Company of Needham Heights, takes a leading place. It is one of the largest, if not the biggest underwear concern in the country. The Carter business was founded about sixty-three years ago, by the late William Carter, a native of Alfreton, Derbyshire, England, who landed in New York, January 28, 1858, after a tempestuous journey of fifty-two days on a sailing ship, during a part of the voyage the passengers subsisting on three ship crackers and a quart of water a day. Mr. Carter's worldly possessions were an upright character, unbounded courage and \$2.50 in cash. With these he started a career that earned for him the love of his employees, the high regard of his fellow-townsmen and business associates and the confidence which enabled him to render assistance to those less fortunate than himself. At his death on July 16, 1918, it was said of him that, next to his own family, his employees were the chief mourners for there was a mutual confidence between them built up by many years of goodwill and square dealing that still keeps his memory green. That mutual confidence between the company and its employees still exists—a valuable asset that cannot be measured.

Mr. Carter's father, a knit hosiery manufacturer, had taught his son

the art in his early youth and the latter became an expert workman and was intrusted with the task of making silk stockings for the Prince of Wales, later King Edward VII. Fortune frowned on him for a time after his arrival but he plodded along cutting wood, digging peat, knitting when he got the chance and always doing well the job at hand, a lesson which he inculcated in his children and employees. Finally he saved enough to buy a knitting machine and installed it in the kitchen of his home, at Needham Heights, where he began the manufacturing of cardigan jackets, selling them to Boston jobbers. Later he added another machine and hired a neighbor to operate it. Step by step the business grew, new lines were added, and, in 1872, it was located in a commodious factory. In 1878 the manufacture of infants' and a general line of underwear was begun and later men's and women's lines were added. Two of his sons, William H., and Horace A. Carter, were taken into the business, learned it from the bottom, then were placed in executive positions and have successfully guided its destinies up to the present. About 1898, the two sons were so impressed with the future prospects of the industry that they favored breaking relations with commission houses and marketing their product direct to the retail trade. This was a heroic step to take and many Jeremiahs predicted its failure but it was successful and the "quality first" standard of Carter goods soon became nationally known. Today its sales force of approximately 100 men covers every state in the Union, as well as South America and South Africa. The company maintains offices and supply stations in New York City, Philadelphia, Dallas, Cleveland, Chicago, San Francisco and Boston. This year Europe is being invaded and a foreign department has been created to care for the export trade in that part of the world, as well as in China.

The company was one of the pioneers in sensing the possibilities of rayon underwear and installed special and exclusive machinery for that purpose at an expense of approximately \$750,000, an investment that was courageously made, and a venture that has been most successful, the company's sales in 1927 reaching \$5,750,000, a new high record as measured in dollars, notwithstanding the fact that prices were substantially below those of the years from 1918 to 1920. At present, the production at the Springfield plant is about half rayon, the remaining half being fine merinos, silk and wool garments. The manufacture of rayon products has been concentrated at the Springfield plant, and it is anticipated that this unit ultimately will be devoted exclusively to rayon. The Needham Heights plant is largely given over to the production of infants' underwear of high grade, other than rayon.

Today rayon underwear is one of the company's leading lines, although every conceivable type of men's, women's and children's underwear apparel is produced by it. "Distinguish the best from the rest" has long been the Carter slogan and the expansion of the business has proved its efficacy. The growth has been phenomenal, necessitating frequent additions to plants and the installation of the most modern machinery. Today there are mills at Needham Heights and Springfield, in this state, in Barnesville and Macon, Ga., and in Reidsville, N. C. At Barnesville moderately priced all-cotton and merino, or mixed lines, are manufactured, while at Macon, men's and boys' garments are finished, and at Reidsville is the unit for men's woven goods. Some advantages are found by the company in producing medium priced cotton goods in the South, but the

better grades will be manufactured in the Massachusetts plants, as heretofore.

All the units are equipped with every facility, not only for manufacturing goods but also for the comfort and convenience of the workers. Nurses, rest rooms, lunch rooms and many other features are provided. Group insurance is available to all employees of over six months' standing. Two workers with fifty years' service records have already been presented with gold watches and several more are on the way to attain them. A twenty-five-year service club would require a good sized hall to accommodate its members.

Roscoe A. Carter, the assistant treasurer, who was the youngest son of the late William Carter, and who for over twenty years has been active in the management of the business, died in December, 1927.

Hon. William H. Carter, president of the corporation, represented his district in the Massachusetts legislature and the 13th Massachusetts Congressional District, at Washington, D. C., for four years, retiring in 1918 to devote his full time to the company's business. He has also served the town in various capacities.

Hon. Horace A. Carter, the treasurer, was a member of the Needham School Committee for twelve years and was a member of the Governor's Council for several years, serving at the time of the Boston police strike when he loyally supported Governor Coolidge throughout that troublesome episode. He is a trustee of Boston University, has served as Deputy Grand Warden of the Grand Lodge of Masons in Massachusetts, is connected with a number of important business enterprises and societies, and is president of the Needham National Bank.

The company is capitalized for \$3,500,000 and employs upwards of two thousand workers. The present officers of the company are: Hon. William H. Carter, president; Hon. Horace A. Carter, vice president and treasurer; H. Ronald Carter, secretary, and Lyndall F. Carter, assistant treasurer.

THE KNIT GOODS TOWN OF NORFOLK COUNTY

Needham is a knit goods center of importance, as in addition to the William Carter Co., are a number of other large units, including Benjamin Moseley Co., Inc., established in 1914, and incorporated in 1921, with capital of \$80,000, employing fifty in the manufacture of women's and children's sweater coats, Frederick Bailey being president and treasurer; the Simons Knitting Mill, at Needham Heights, owned by George Simons, producing infant's and children's links and links goods, novelties and sweaters; the Crescent Knitting Co., owned by John H. Ramsey, engaged in the production of sweaters and kitted neckwear; The Enterprise Knitting Co., of which Andrew Lumsden, is president, and Edgar S. Stanley, is treasurer and secretary, and producing knit wear; The Evans Knitting Co., employing forty in the manufacture of woolen and worsted shaker sweaters, bathing suits, athletic suits and tights; Moseley & Company, Inc., with capital of \$60,000, employing fifty operatives, in the manufacture of children's ribbed shirts and bands, shawls, mufflers, ribbed underwear and fancy knitted goods, William G. Moseley being president, and Charles B. Moseley, treasurer of the corporation. This concern was established in 1880 and incorporated in 1915. The Needham Knitting Mills Co., established in 1921, owned by David Cohen, manufactures women's and children's sweater coats and links. The William Gorse Co., Inc., which

was incorporated in 1924, with capital of \$15,000, produces silk, cotton and surgical elastic bandages and corset fabrics. H. M. Gorse is president, A. W. Littlehale vice president, assistant treasurer and general manager, and M. M. Gorse, treasurer and secretary. The Sports Hosiery Co., established in 1925, and owned by J. W. Shardlow, manufactures men's women's and children's seamless golf and sport hose. Charles Walton & Son, owned by Oliver H. Walton, produces seamless elastic hosiery, and employs thirty-five operatives. T. S. Walton manufactures men's, women's, infants' and children's silk and worsted knitted outerwear, sweaters, caps and mittens. The Charles River Bleachery & Print Works dye, bleach, print and finish cotton piece goods, having a daily capacity of six tons. J. Eugene Cochrane is president, John Cochrane treasurer, D. Cochrane secretary and agent, and the concern employs eighty operatives.

The William F. Alden Company, owned by William F. Alden, manufactures covered rubber thread.

THE MAC GREGOR INSTRUMENT CO.

In 1915 there was incorporated, under the laws of Massachusetts, as a small sales organization, purchasing its goods from various manufacturers, particularly the Baird Company, of Plainfield, N. J., a concern which took the name of the MacGregor Instrument Company, with its headquarters in Roslindale.

Two years later the assets and business of the Baird Company were purchased by the MacGregor concern, which was incorporated and removed to a plant in Needham, where the manufacture of surgical instruments was commenced, the company specializing in hypodermic needles and syringes, as well as special outfits for surgeons and physicians such as the Scannell apparatus for blood transfusions, local anaesthesia and other treatments built around syringes and needles as the nuclei.

The MacGregor Company was the first unit in the United States to introduce hypodermic needles fashioned out of stainless steel, and today, after five years of this type of production, the old-fashioned carbon steel instruments have passed out of the picture.

Many of the largest hospitals and institutions in this country, as well as abroad, are utilizing the products of the Needham concern, which has won, in considerably less than a decade, an international reputation among scientists, physicians, surgeons and dentists as the producer of surgical and dental specialties of the highest quality.

John MacGregor is president and William W. Gallagher is treasurer and secretary of the company, which has capital of \$88,000 and employs fifty operatives.

THE FRANK W. GORSE COMPANY

The Frank W. Gorse Company was established at Needham Heights, in 1893, to manufacture surgical elastic goods, and seven years later it added the production of covered rubber thread. After growing steadily until 1916, the United States Government found the product made by the Gorse company necessary for the elastic used in gas masks, and during the two-year period from 1916 to 1918, it increased its capacity 500%, the entire product being taken by the government.

During the past ten years it has trebled its Needham plant, and has duplicated its entire equipment in another factory, at Central Falls, R. I.,

until it has become the largest unit in America furnishing covered rubber thread to the elastic corset trade.

Frank W. Gorse is president and treasurer of this fast growing concern, which employs seventy-five operatives.

The Ulett Manufacturing Company, Inc., with capital of \$25,000, manufactures cedar battery separators. George A. Ulett is president and F. S. Emery, treasurer.

The Central Railway Signal Co., with capital of \$400,000, is the second largest local employer of labor, utilizing the services of 150 operatives, in the manufacture of fuses and torpedoes for railway signaling purposes. F. A. Buckley is vice president, William F. Bacon secretary, Ralph L. Longden general manager, and William S. Whitman treasurer of the corporation.

Edward E. Dailey employs fifty operatives in the manufacture of paper boxes.

The Horace Partridge Co., with capital of \$125,000, employs fifty operatives in the manufacture of sporting goods, J. F. Conway being president, and T. F. Flanagan treasurer of this concern, which maintains a large wholesale and retail selling unit at 49-51 Franklin Street, Boston. It equips many of the American and National League baseball teams with uniforms and accessories.

The Steelix Company, capitalized at \$225,000, manufactures piston rings, and other products, Lewis C. Marshall being president, Francis A. Foster treasurer and Harris H. Gilman clerk of the corporation.

The Q P Signal Co., with capital of \$88,000, of which corporation Walter K. Queen is president and Preston Mitchell treasurer, produces power station signal systems and high pressure packing trolley catchers. The company operates another plant in Medfield.

The Old Trusty Dog Food Company employs seventy-five operatives in the manufacture of dog foods. Walter U. Nowell is president and Durant Rice treasurer.

NORFOLK'S INDUSTRIES

Paper mills were operated at periods during the last century at Island Lake and in the west part of the town of Norfolk.

Silas Mason of Norfolk was given a patent on February 20, 1819, on a carding machine for manufacturing hats, which produced the hat in its conical form in one operation.

Today, Buckley & Mann, Inc., employ fifty operatives in producing re-worked wool, Thomas M. Buckley being president, Frank M. Buckley secretary and Albert H. Mann treasurer of the corporation, which operates a branch plant in Hyde Park. This concern started in a modest way but a few years ago and has experienced a steady and healthy growth.

One of the units of The American Felt Co. is located at City Mills, where the dyeing, finishing and manufacture of felt goods is carried on, 100 operatives being employed.

NORWOOD'S MANUFACTURES

AMERICA'S OLDEST AND LARGEST SHEEPSKIN TANNERY

Undoubtedly the pioneer, and at least the oldest in continuous existence in the United States, in the tanning and manufacture of sheepskins, is the firm of Winslow Brothers & Smith Co., which witnessed its beginning the

year of American independence. Today, the concern is the largest handler of sheepskin in the world.

In 1776, Abner Guild began the tanning of sheepskins in what was then South Dedham, now Norwood. Fifteen years later, Guild took John Smith, a lad of seven years, who later became his successor in the business, as an apprentice.

Early in the following century, George Winslow, who had learned the tanner's trade and had operated a plant in Roxbury, married John Smith's daughter and in 1818 became a member of the firm of Smith & Winslow. The senior member retired in 1831 and was succeeded by his son, Lyman. In 1853, the latter, with his sons, John E. and Charles L., built a tannery opposite what is now the Norwood depot, and operated under the name of Lyman Smith & Sons, which, after the retirement of the father was continued as Lyman Smith's Sons until it was incorporated in 1890 when the concern became Lyman Smith's Sons Co.

When Lyman Smith withdrew from Smith & Winslow, in 1853, George Winslow & Sons continued at the old location until 1860 when the senior member retired and was succeeded by his sons, George S., Martin M., Elisha F. and Francis O., who operated under the name of Winslow Brothers. In 1890, Lyman Smith & Sons incorporated under the laws of Massachusetts as Lyman Smith's Sons. Just after the dawn of the present century the Winslow and Smith concerns consolidated, and were incorporated in 1901, under the name of Winslow Brothers & Smith Co., the two Norwood tanneries being known and operated as the Winslow and Smith plants, respectively.

Since that time the concern has grown by leaps and bounds. In 1906 the company acquired the Morrill Leather Co., which owned a large tannery in Peabody, and a concern which traced its life back to 1836, when Levi Morrill established a sheepskin business there. About this time the company acquired and reorganized the Brandt Leather Co., which operates a plant, in Norwood, that has become known as one of the largest producers of high-grade fancy sheep, calf and goat leathers, as well as manufacturing all lines of cut hat leathers.

In 1928 the business previously conducted by the Eastern Leather Co., a subsidiary of the J. K. Mossett Leather Corporation, was merged with the Winslow Bros. & Smith Co. The aggregate tanning capacity of the two Norwood plants, the Peabody unit, and another in Gloversville, N. Y., is 9,000,000 sheepskins a year.

The company also owns and operates at Norwood a fully equipped wool pullery, capable of handling 5,000 skins per day, and a scouring and carbonizing plant, in the same town, with a capacity of 15,000,000 pounds of wool a year. Through Winslow & Co., Inc., a wholly owned subsidiary, a general wool business is transacted, while at the plant of the Brandt Leather Co., another entirely owned subsidiary, at Norwood, cut hat leathers are manufactured. The parent concern is capitalized for \$2,500,000, and employs upwards of 1,200 operatives, maintaining a Boston office at 248 Summer Street and stores in Boston, New York and Chicago.

That the corporation has not retrograded is indicated by the fact that in 1853 when the unit of Lyman Smith & Sons was formed, all the business at that plant was carried on in two buildings, while today all the space afforded by twenty-one structures is occupied, the Smith plant being

one of the few in New England that is still employing hemlock bark for tanning. This unit specializes in roller, law book leather, and shearlings.

But at the Winslow plant perhaps the greatest changes and developments have taken place since the consolidation in 1901, for it is here that the large wool pullery, the direct outgrowth of the business begun by Abner Guild in 1776, is located. At this plant there is still in operation a number of underground sweat boxes by which the wool is removed from sheepskins. The painting and liming processes are also used, giving this firm a wide range of sheep leather in which the desired characteristics can be more nearly perfected in each line by means of regulating the preliminary work before tanning commences.

The company is one of the largest, if not the largest handler of pulled wools in the country. Many inventions used in the tanning of sheepskins have been made at the Winslow plant, the concern having constructed one of the first "putting out" machines ever used in a leather plant.

The Brandt Leather Company, also operated by the parent company, is one of the largest producers of high grade fancy and hat leathers in the country, and is known the world over for the quality and style of its products. Having representatives in the principal leather centers of this country, the concern also has sales offices in Paris, Milan, Hamburg and Buenos Aires, where its leathers enjoy the highest reputation.

In the textile industry Winslow Bros. & Smith Co. is known as the earliest and probably the largest producers of roller leather in this country.

The growth of the Winslow plant required a more adequate provision for water supply than had been enjoyed and, anticipating future needs for a long time to come, a unique and adequate supply was provided by forming within a radius of two miles no less than six ponds, which are so situated that by gravity an open brook supplies the huge reservoir fifty yards in diameter, located in front of the main plant and which serves as a pond to beautify the landscape, as well as the direct supply for the plant.

The water for all the wet work in the pullery and tannery is drawn from this reservoir by gravity and pumps draw their supply from here to all parts of the buildings and for fire purposes.

The sewage problem is well taken care of by means of settling tanks to remove heavy sludge; and with purification tanks and filter beds to remove all further solids before the final effluent enters Hawes Brook. The concern has capital of \$2,500,000 and it employs 750 operatives.

The president of the corporation during its greatest period of growth and prosperity has been the present governor of this commonwealth, Hon. Frank G. Allen, who is now the president of the board of directors. Cheney E. Cook is president, and Kenneth S. Domett is treasurer.

In 1854 the Norwood Iron Foundry was established and is now owned by J. E. Plimpton, who operates it under the name of the J. E. Plimpton Company.

Norwood's largest local employer of labor is the famous Plimpton Press which has long stood for the highest craftsmanship in the art of printing books. Capitalized for \$761,500, it keeps 700 operatives steadily busy in turning out the finest specimens of book work. Herbert M. Plimpton is president, A. E. Barter secretary and R. Mayo Smith treasurer.

The George H. Morrill Co. was founded by Samuel Morrill and almost



PLIMPTON PRESS, NORWOOD

from its inception it began to export its famous printers' inks to foreign lands.

Capitalized for \$1,000,000, it employs 175 operatives at its Norwood plant. The present officers are George H. Morrill, president; Leon G. Morrill, secretary, and Frederick P. Bagley, treasurer. It maintains a Boston office at 155 Pearl Street.

The Berwick & Smith Co., with capital of \$250,000, employs 150 hands in quality book printing, Clara Berwick Walker being president and treasurer of the corporation and Louis E. Flye secretary.

The Boston Piano Supply Co. manufactures piano felt hammers and damper wedges, employs seventy-five operatives, is capitalized for \$50,000 and maintains a Boston office at 211 Congress Street. E. H. Allen is president, A. E. Barter, secretary and R. Mayo Smith, treasurer.

The J. S. Cushing Co., with capital of \$200,000, more commonly known as the Norwood Press, is another large Norwood unit engaged in printing and electrotyping, and employing 175 operatives. Oliver J. Barr is president, and James S. Cox secretary and treasurer.

E. Fleming & Co., a partnership made up of Charles T. Baker and Charles B. and Samuel N. Fleming, and whose main plant is in Cambridge, maintains a branch unit in Norwood, 400 operatives being employed in the two units.

One of the plants of Bird & Son, Inc., of Walpole, is located in Norwood.

The Holliston Mills, Inc., established in 1893, and incorporated in 1920, are engaged in the dyeing, bleaching and finishing of cotton cloth for book stock. Harold E. Shaw is president, E. J. Baker vice president, V. C. Britton secretary, H. M. Plimpton treasurer, and H. W. Plimpton assistant treasurer of the corporation.

The Norwood Stamping Co., Inc., manufactures headers and wires for roofing and floor covering, Benjamin Sachs being president, and Benjamin Cushing, treasurer of the concern.

The Victory Fertilizer Co., with capital of \$50,000 is engaged in the production of fertilizers. Myron L. Jackson is president, Leonard G. Roberts secretary and Frank E. Jackson treasurer.

Wellington & Co., Inc., produces medicines, the concern having a capital of \$24,000. Mrs. L. E. Wellington is president and James T. Wellington treasurer and secretary.

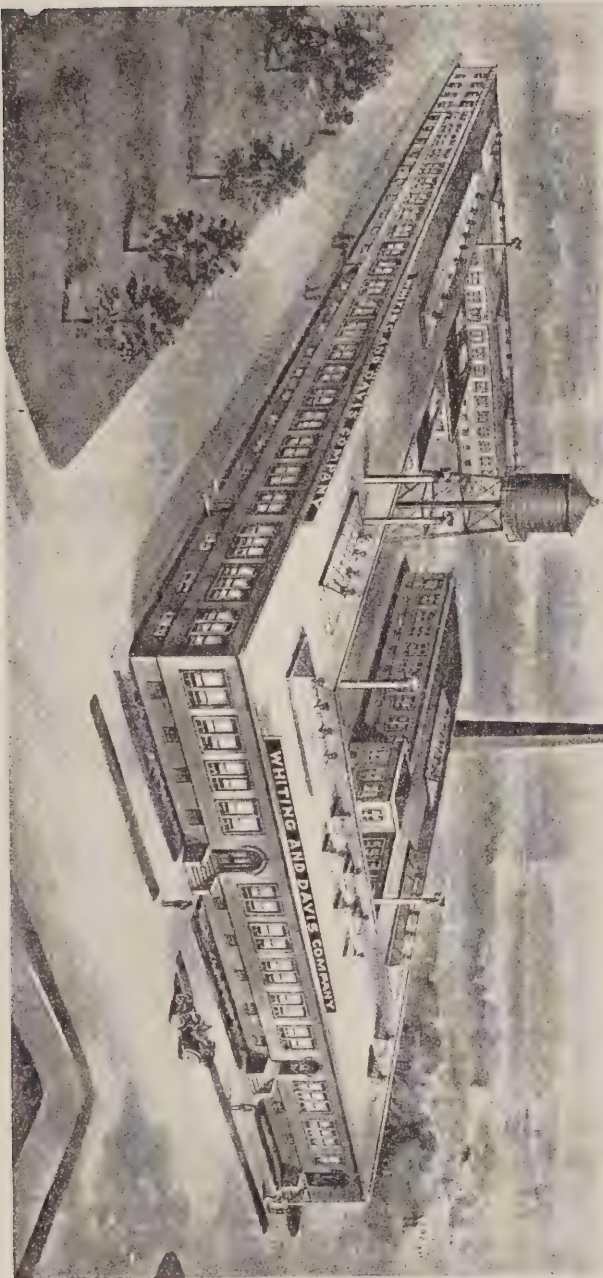
The American Felt Company operates one of its three Massachusetts plants in Norwood.

THE WORLD'S LARGEST MANUFACTURERS OF SPECIALTY JEWELRY

The year of the Centennial Exposition, at Philadelphia, witnessed the birth of the firm of Wade, Davis & Company, of Plainville, which, as the Whiting & Davis Company, manufacturers of mesh bags and metal mesh for many uses, stands today as the world's largest specialty manufacturing jewelry organization in its line. William H. Wade, Edward P. Davis, and Louis Heckman, as active partners, and Joseph T. Bacon, James D. Lincoln, and Frank Tift, as silent partners, each contributed \$500 to the firm, making its entire initial capital of \$3,000 look rather insignificant beside the \$1,000,000 capitalization of today.

The popular items manufactured by Wade, Davis & Co., more than half a century ago were plated bar pins, earrings, bracelets, and stick pins.

An interesting side light on manufacturing costs is observed by com-



WHITING AND DAVIS COMPANY, PLAINVILLE

paring one of the first payrolls of the parent company, with one of the present day payroll sheets of the Whiting & Davis Co. It is a far cry from the low wages and simple life of 1876 to the conditions existing in 1928, when the lowest paid operative earns more than each of the six partners received as their share, more than fifty years ago.

In 1880, four years after Wade, Davis & Co. began business, Charles A. Whiting, now president and treasurer of Whiting & Davis Co., entered the employ of the old concern as errand boy and general utility man, and received the princely sum of nine cents per hour for his services. When the old company began manufacturing it occupied 2,500 square feet of space, while today upwards of 80,000 square feet are used. In 1890, Mr. Whiting became a member of the firm, and in 1896 it was renamed Whiting & Davis.

In 1892 Mr. Whiting made the first mesh bag. Up to that time, mesh had been hand-made in gold, and limited quantity, by goldsmiths, and it was not until 1909 that A. C. Pratt invented the first machines for manufacturing the material. By the purchase of Mr. Pratt's patents the Plainville concern became not only the pioneer, but the exclusive manufacturers of machine-made mesh. In the intervening years the processes have been vastly improved at the plant, until today the machines, almost uncanny and human in their operation, link the tiny rings of Milady's gossamer-like mesh bags at a speed of 400 rings a minute. One who has not witnessed these devices, operating under power, cannot appreciate the ingenuity and skill of the men who designed and produced them.

The basic and subsequent patents on the original and present machines were, and are, so sweeping that foreign and other American manufacturers who have sought to build mesh-making machines have been obliged to confess defeat.

Mesh is made on 500 machines installed in the Plainville plant, each provided with automatic stops and individual motor drives, making it possible for a single operator to run a battery of twelve machines. Automatic machines now do practically all of the cutting, splitting and joining of the mesh, operations which formerly were accomplished by hand.

All mesh machines and automatic machinery used by the Whiting & Davis Company are designed and built in the factory by a corps of expert workers. Many of these machines cost thousands of dollars in passing from the experimental stage to the perfected mechanism.

In the stamp and press departments are many other special machines, such as heavy automatic hammers, presses and other machinery necessary to the making of mesh bag frames. Hammers for stamping a frame range from 150 pounds to 600-ton pressure. In this department there are also many expensive tools used for the needs of each particular style of frame, and these are all designed and made at the factory. In fact, the progress of the Whiting & Davis Company has been due largely to its success in building time and labor-saving machinery to economically produce its product.

The new mesh machines recently developed in this department have opened up a wonderful new field in mesh design. These devices, on which patents have been granted, are producing effects equal to those of the jacquard loom of the textile industry. By combinations of sterling silver wire, red, green and roman gold wire, surprisingly novel and beautiful

fleur-de-lis, check, mosaic, and bird-in-cage patterns in ring mesh are produced.

These machines are so constructed and operated that their mechanical fingers will, with unvarying precision, cut off the length of wire required for a tiny ring, form it into a ring and engage or weave it into the mesh pattern in the combination of different colored metals desired.

It is this constant search for new, better and novel mesh-making methods and effects and their successful creation which has done much to maintain the popularity of the mesh bag.

Since 1891 the national advertising of the concern has set a standard of individuality, created an increasing demand for the product, and stabilized the industry.

Leading theatrical and screen productions such as "The Music Box Revue," "The Cocoanuts," "Black Oxen," and other stage successes, have utilized the products of the Plainville concern in dazzling costuming and scenic effects.

Capitalized for \$1,000,000, the concern employs 700 operatives. Charles A. Whiting is president and treasurer, and B. S. Gardiner, secretary of the corporation.

PLAINVILLE'S OTHER INDUSTRIES

H. M. Richards, the pioneer Plainville jewelry manufacturer, was succeeded in 1844 by Joseph T. Bacon, John H. Hodges, and George Mason, who occupied the old Slack Mill, Mr. Mason withdrawing from the firm a few years later. Messrs. Bacon & Hodges continued the partnership until 1850, when the latter retired. In April of that year, the Slack Mill was burned and a new factory was erected, and occupied by Draper, Tift & Bacon, and upon the death of John Tift the concern became Draper, Tift & Co. Upon the retirement of Mr. Draper in 1860, the name was changed to Lincoln, Tift & Bacon. In 1876, on the death of Frank L. Tift, it became Lincoln & Bacon and in 1882, Lincoln, Bacon & Co.

John B. Maintien succeeded J. E. Maintien in the enameling business, in 1855.

In the spring of 1872, a partnership under the style of the G. Demarest Co., was organized, in Plainville, to manufacture jewelry, the promoters being George Demarest, William H. Rogers, John J. Barrett, Davis D. Reed, Henry Packard, Bradford B. Corbin, Richard Donnell, Edward P. Barnett, Daniel H. Corey and Albert W. Benton, and upon the withdrawal of Mr. Demarest and others, in 1873 and 1874, the firm name was changed to the Plainville Stock Co. In 1876 the concern moved to a new factory which it built, and between that year and 1913 all of the partners withdrew except William S. Metcalf, who had purchased an interest in 1876. In 1919, the latter's son, Leroy A., was admitted to the firm, and in the spring of 1924, William S. Metcalf, after engaging in the jewelry business for almost fifty-three years, retired, and on July 29, of that year, the Plainville Stock Co. was incorporated, Nelson C. McCormick being elected president, Julius Wiesman vice president, and Leroy A. Metcalf treasurer. The concern manufactures a permanent white line of jewelry, and employs seventy-five operatives.

In 1890, E. Leroy and L. Eugene Robinson began the manufacture of jewelry.

Thompson & Remington is one of the best known refiners of gold and silver in New England, as well as one of the oldest.

A native of Halifax, in this state, Mr. Thompson early became interested in metal refining, and entered the employ of C. E. W. Sherman & Son, of North Attleboro, where he remained for five years. On June 5, 1898, he began business in his own name, and a year later Byron A. Remington became a partner in the firm of Thompson & Remington. In 1916 Mr. Thompson bought his partner's interests, and is now sole proprietor of the concern.

S. W. Olney began the local manufacture of jewelers' findings in 1883.

The Plainville Braided Rug Mfg. Co., owned by R. Paulus, manufactures braided and hooked rugs and carpets.

PORTABLE BUILDINGS AND SHOES ARE PRODUCED IN RANDOLPH

Twenty years ago construction was a slow and costly process. All lumber was cut and fitted on the site of a new building; the quality of material was uncertain; and the completed structure was likely to prove unsatisfactory, while the costs almost invariably exceeded the original estimates.

The thought occurred to Eddy C. Young, founder of the E. C. Young Co. of Randolph, that standardization might be applied to buildings, precisely as it was being accomplished in fabricating automobiles, and that structures of uniform quality could be turned out in quantity at greatly reduced costs.

With this idea as the starting point, Mr. Young began in a small way to construct garages and bungalows. Soon he was buying lumber by the carload and was installing labor-saving machinery in his then modest plant, and later he established delivery and construction services, and, in 1920, he added a line of summer camp buildings, until, by 1927, the Young company delivered and erected upwards of two thousand garages and more than two hundred camp and bungalow structures. The concern was the first in New England to manufacture wooden garages, and its history bears out Ralph Waldo Emerson's assertion that "every institution is but the lengthening shadow of a man."

Today, seventy-five employees are carried on the company's payroll where, a score of years ago, Mr. Young and a helper were able to carry on the work. In 1928, the company marketed more than two thousand garages and over two hundred camps and bungalows. Martin E. Young, son of the founder, is now manager of the business.

For years Massachusetts has led the field in designing and manufacturing portable buildings of all kinds, and the Atlas Portable Building Co., engaged in the production of portable and permanent structures is another unit that adds to the local payrolls.

Peter B. Sullivan is president and George F. Taylor is purchasing agent and sales manager of the corporation.

The Randolph Portable Building, Inc., of which George P. Pierce is president, is another local concern in the same line of manufacture.

M. B. Claff & Sons, Inc., with capital of \$50,000, employ forty operatives, in the manufacture of paper boxes, and also operate a plant in Brockton. Mark B. Claff is president and treasurer.

The manufacture of shoes has long been prominent in Randolph, and today the Richards & Brennan Company, capitalized for \$300,000, em-

employs 135 operatives, James Brennan being president and William J. Brennan treasurer of the corporation; the Royal Shoe Company, with capital of \$60,000, employs sixty in the manufacture of men's footwear, Louis E. Flynn being president and Fred L. Hayes treasurer of the corporation; the Rubberhide Company, with capital of \$30,000, manufactures boots, shoes and leather novelties, K. Chase being president, secretary and treasurer, and A. Madan vice president of the corporation; and Richard C. Goggins erected a last factory in 1928.

Randolph's nine manufacturing concerns used stock and materials valued at \$615,316, in 1927, paid 252 employes \$279,880 in wages, and made products valued at \$1,227,001.

THE INDUSTRIES OF SHARON AND STOUGHTON

Seth Boyden, Jr., operated a file manufactory, in Sharon, during the earlier years of the nineteenth century, the plant becoming famous about the time of the War of 1812 as the producer of files unequaled by any in the American market. In September, 1810, the inhabitants of Sharon gave permission to Joseph Hewins to build a dam in the road near the residence of Samuel Hewins, and the following year he built the first cotton factory erected in the town.

In later years nails and woollens were manufactured in Sharon. In the southerly part of the town another nail manufactory was established while nail and carding mills were operated on the Massapoag, in 1830. The production of straw bonnets and palm leaf hats was carried on between 1825 and 1830, and the manufacture of shoes was an increasing business between 1820 and 1830. The raising of mulberry trees and the rearing of silk worms interested many Sharon people in the early '30s.

The local industries of the present day include the Bay State Film Co., producers of motion picture and photographic films, William J. Smith being president, S. E. Duffin vice president and Col. Charles H. Cole treasurer; the Roxbury Screw & Gear Works, manufacturers of screw products, of which Fred A. Heuser is president and treasurer and E. B. Heuser secretary; the Sharon Box Co., of which Charles F. Smith is president and treasurer, producers of wooden boxes and shooks; and F. M. Tafton & Co., owned by F. M. Tafton, manufacturers of metal polish. In 1929, the Sharon Box Company erected a modern factory to take the place of the plant which was destroyed by fire the previous year.

The manufacture of shoes began in Stoughton as early as 1816, when John Linfield, the pioneer shoemaker of the town, commenced business, followed five years later by Isaac Beals, and still later by Simeon Drake.

In 1860 the value of boots and shoes locally produced had risen to \$1,300,000 and the industry afforded employment to 1,200 men and women. The Stoughton Boot & Shoe Co., established in 1872, was the first unit to operate its plant by steam power.

In 1883 the value of the local shoe products had fallen to \$900,000, the business then being conducted by thirteen firms.

In a West Stoughton factory, where, originally blue woolen yarn for men's stockings was produced by a four-set mill of thirty-inch woolen cards and hand spinning jacks to match, were lined the first pair of overshoes that entered the American market.

In 1858, Charles H. French, a former resident of Canton, and Henry Ward, an English knitter by trade, formed the partnership of French &

Ward, and purchasing a small water privilege and mill in Stoughton, began knitting men's, women's and children's cardigan jackets, adding, in 1870, a knitted fabric for lining Arctic overshoes and gloves.

The business has been carried on for nearly three-quarters of a century by the sons and grandsons of the founders, and 125 operatives are employed. The concern maintains a New York salesroom, and the present-day partners are Charles H. French, Malcolm B. French and Holcombe Ward. Woolens, worsteds and eider-downs constitute the present products. The plant has 960 spindles, three sets of cards, 120 knitting machines, and dyes, bleaches and finishes its products.

THE CHARLES STRETTON & SON COMPANY

The Charles Stretton & Son Company was established in 1869, by Charles Stretton, who manufactured cardigan jackets at Ponkapoag, and was incorporated in 1909. During these sixty years, the business has undergone many changes, not only in personnel but also in methods of manufacture and products—always developing something newer and better in women's knitwear.

Artificial silk and wool enter the Stretton factory in skeins and leave in the form of beautiful lingerie, bathrobes, negligees, scarfs and dresses, often bearing the labels of many of the most exclusive stores.

With capital of \$75,000, the concern employs upwards of 100 operatives. Charles W. Jones is president and treasurer, and Arthur L. Southworth secretary of the corporation.

KENWORTHY BROS. CO.

In 1908 Harry J. and Herbert H. Kenworthy formed the Kenworthy Bros. Co., as a partnership, to job felt, beginning business in Boston. Three years later the Kenworthy Bros. Co. was incorporated, with capital of \$50,000, which, in 1916, was increased to \$150,000. In 1913 the concern began cutting felt for the shoe industry, including heel pads, box toes and tongue linings, and the following year the Kendex Insole was invented and a factory opened at Stoughton for the manufacture of this product, which is a chemically treated felt or cotton goods material and used as an insole in shoes, particularly canvas rubber soled footwear, being generally employed in all the high-grade tennis footwear manufactured in this country and Canada, and sold extensively in England. The company's business is almost exclusively carried on with the shoe trade, and in addition to the lines alluded to the concern manufactures and markets cut imitation leathers. Fifty employees find constant employment at the Stoughton plant. H. J. Kenworthy is president and F. S. Arend secretary and treasurer of the corporation.

OTHER INDUSTRIES OF STOUGHTON

The Meade Rubber Co., with capital of \$150,000, employs seventy-five operatives in the manufacture of rubber heels and sheeting, having a Boston sales office, at 186 Lincoln Street. James Myles Meade is president and treasurer, P. H. Mahoney vice president, David J. Fraser assistant treasurer and Matthew Meade secretary of the corporation.

One of Stoughton's large and famous industrial units is the J. W. Wood Elastic Web Co., which was incorporated in 1910, and was capitalized at \$200,000, engaged in the manufacture of elastic webs and

cords, and employing 250 operatives, John W. Wood being president, and Miss Katherine A. Crimmins secretary and treasurer, they with Peter Wood, constituting the board of directors. The plant is equipped with seventy-five looms and 200 braiding machines.

F. C. Phillips employs 60 operatives in the manufacture of screw machine products and nickel plating; the Perfection Cooler Co., whose main plant is at Michigan City, Ind., maintains a branch unit in Stoughton; the Packard Dressing Co., owned by E. L. and R. B. Toomey, produces shoe polishes.

The Greb Co., Inc., with capital of \$100,000, is engaged in the manufacture of automotive and service station equipment, George W. Grebenstein being president and treasurer and Henry D. Grebenstein secretary of the corporation.

One of the two plants of the American Rubber Co. is located in Stoughton, the other at Cambridge, both being subsidiaries of the United States Rubber Co.

The George E. Belcher Co., with capital of \$250,000, employs 150 hands in the manufacture of shoe lasts and forms, J. Howard Leman being president, E. B. Southworth vice president and G. H. Belcher treasurer.

F. E. Benton & Co., owned by E. M. Fullerton, produces shoe last supplies.

The Panther Rubber Mfg. Co., with capital of \$105,000, manufactures rubber soles and heels, and employs 300 operatives, Frank Bernstein being president and Philip Bernstein treasurer; and the Shawmut Woolen Mills, incorporated in 1916 and capitalized at \$250,000, produces woolen and worsted lightweight knitted goods, affording employment to 250 operatives. R. H. Wyner is president and secretary and George Wyner treasurer.

The Stoughton Mills, located at West Stoughton, with capital of \$75,000, employs 120 operatives, in producing reworked wool, P. M. Bromfield being president, Harold A. Broomfield secretary and R. Broomfield treasurer of the corporation.

The Upham Bros. Shoe Co., with \$200,000 capital, employs 250 in the manufacture of women's shoes, A. A. Mead being president and C. S. Upham secretary and treasurer of the concern.

The Norfolk Knitting Mills manufacture men's, women's and children's sweaters, athletic and bathing suits and jerseys.

The Frieze Manufacturing Co., owned by Herman H. Frieze and Antonio Bednarz, employs seventy-five operatives in the manufacture of raincoats.

Watson Shoes, Inc., has capital of \$150,000 and employs 225 operatives in the manufacture of women's footwear. Albert N. Blake is president, Frank C. Stetson, vice president and Charles Gleason, treasurer.

Matthew Townsend, who at one period was a member of the local firm of Draper & Townsend, was the inventor of the knitted carpet lining and stair pad, and of a patented knitting latch-needle.

In 1911, Michael S. Kelley, a native of North Bridgewater, now Brockton, who in his early years removed to Milford, where he was superintendent of the Milford Shoe Co., and later the owner of a shoe factory there, operated by himself and his sons, George P. and Leon, transferred his manufacturing operations to Stoughton, where he became prominent in town affairs and active in civic enterprises.

Stoughton's twenty-six manufacturing concerns used stock and materials valued at \$4,990,740, employed 1,367 workers who were paid \$1,697,870 in wages, and placed on the market commodities valued at \$9,016,377.

THE NEPONSET RIVER A GREAT POWER ASSET TO WALPOLE

Located on the Neponset River are ten distinct water privileges, with a combined fall of 151 feet within the limits of the town of Walpole. The Elbridge Smith dam, with a fall of fourteen feet, began furnishing power for a grist mill as far back as 1814, and later cotton goods factories sprung up at that location.

The so-called Henry S. Clark privilege, with a fall of twenty-two feet, provided power for nail, cassimere, satinet, broadcloth, boot and shoe and stocking yarn factories, at various times.

The Old Rucaduc fall, so-called, of twelve feet, has witnessed saw, shingle, carding, cotton, boot and shoe plants operating with its power.

The Blackburn privilege, of seven feet, has provided power to operate saw, machinery, cotton yarn, batting and lamp wick factories, while the Union Factory dam, with a fall of eighteen and one-half feet, has furnished energy to operate snuff, tanning, iron, nail, cotton and woolen factories, at various periods of its existence.

The Walpole Center dam, with a fall of nine feet helped manufacture thread, carpets, cotton products, and machinery, and the Stetson water privilege of twelve feet fall has provided power for grist, tool, cotton, card clothing and fur napped hat factories.

The Linden Spring fall of eighteen and one-half feet turned its wheels in behalf of tack, snuff, satinet, twine, tool, shoddy, hoe and farm implement plants and the fifteen-foot dam at Bird's upper mill produced power to operate at various times cotton factories until the late Francis W. Bird purchased the privilege on November 8, 1838, since which time it has served the corporation now known as Bird & Son, Inc.

Bird's lower mill privilege, with a dam of twelve feet, was the source of power for the paper mill established in 1817-18 by George Bird, father of Francis W. Bird, and until 1882, when the latter sold it to Hollingsworth & Vose Co., it was used by the Bird concern, but for forty-eight years has supplied power and water to this well-known Boston paper manufacturing corporation.

On Spring Brook, in Walpole, the Diamond Factory privilege, with a fall of fifteen feet, has faithfully served cotton, straw bonnet, thread, wool and machinery concerns; while the Morey privilege, on Mill Brook, with a sixteen-foot dam, has provided power for a wide variety of local industries since it was built.

THE ROMANCE OF BIRD & SON, INC.

The history of the evolution of Bird & Son, Inc., is another of those entrancing and romantic transformations wrought in Massachusetts industry, beginning on primitive water powers, in the town of Needham and Dedham, in 1795.

That year George Bird came to Massachusetts from Union, Maine, and built his first mill in Needham, removing to Mill Village in Dedham, in 1803, where he carried on the production of paper by hand for two years before machinery was employed in the mill.

In 1812 Mr. Bird purchased real estate in East Walpole, owned by James Richardson, Josiah Daniel and Eliphalet Baker, located on the banks of the Neponset River, and there erected a dam and paper mill, the latter unit being the first of its type that was located on the stream. Here he produced newsprint paper, and, in 1817, his son, Col. Josiah N. Bird, entered the firm, later becoming sole owner of the plant.

For nearly a century and a quarter the Bird products have been manufactured at the same water-privilege upon which the original mill was located, where now stand the main plant and executives offices of the concern.

From its inception to the present Bird & Son, Inc., has remained in the control and under the management of George Bird, the founder and his lineal descendants. On April 1, 1833, Francis W. Bird, another son of George Bird, formed a co-partnership with Stephen Roberts, and began the production of paper in the Neponset mill formerly owned by Col. Josiah N. Bird, this partnership being dissolved the following June. Mr. Bird continued the business, with his father, George Bird, and, in 1838, he bought the mill owned by the Neponset Paper Co., on the Neponset River, which had been operated by Colonel Bird.

Thomas W. Kennedy and others became associated with Francis W. Bird in the operation of this plant, which, for a time, was known as the Bird & Presby mill. In 1871, Mr. Bird sold the plant and water privilege to Zachary T. Hollingsworth, and the Hollingsworth & Vose Co. now operates it as one of its two Massachusetts units.

Up to 1850, the flow of the Neponset River, and a small water-wheel furnished all the power required by the four heaters and paper machines then in service in the Bird & Son plant, and even as late as 1853, three crude machines, operated by water power, provided the daily output of a few tons of paper. A day's production of seventy-three years ago was equal to what is now manufactured at the plant in probably less than an hour. Charles Sumner Bird, son of Francis W. Bird, entered the business in 1877, and since that time a large part of the Bird products has been developed.

New machinery was designed to manufacture new products and old equipment was improved to more speedily handle additional raw materials, until the constant experiments made by able inventors produced revolutionary results.

It was the first concern in the United States to manufacture water-proof papers containing no tar. As the business expanded, the company built at Phillipsdale, R. I., one of the largest felt mills in the country, and the only paper mill in that state, and in 1905 it erected at Hamilton, Ont., a plant to manufacture roofings, while the same year it purchased a paper plant at Pont Rouge, Quebec, in which felt is produced for the Ontario factory. In 1911 a floor covering plant was built at Norwood, and in 1917 it was found necessary to set up a branch roofing factory at Chicago.

Fifty thousand tons of rags are annually fed, with raw materials, to the felt machines at Phillipsdale and Pont Rouge, about 120 tons of dry felt being turned out daily at these plants.

At the main plant, in East Walpole, 60,000 tons of raw material are used yearly in the manufacture of paper.

In 1877 the total tonnage, inward and outward, was twenty tons a

day, while the present plants are handling on the average over 2,000 tons per day.

In 1927 and 1928 Bird & Son, Inc., occupied the position of being the largest individual shippers on the entire New York, New Haven & Hartford R. R. System.

Aside from the manufacture of paper, which was the sole product of the company for 100 years, it now produces a large line of special papers of various kinds, paper boxes, shipping cases, a complete line of building and roofing products, as well as being one of the largest manufacturers in the United States of felt base floor coverings.

Closely associated with Bird & Son, Inc., is the Bird Machine Company, which was organized in 1915 to take over various activities in special machinery which had been carried on by the parent concern. Its chief business is the engineering, manufacturing and selling in this country and abroad of specialties in paper-mill machinery. The plants of the older company provide a practical laboratory for experiments of the machine company in new equipment and methods.

From its inception the value of the human element in industry has been indelibly impressed upon the character of the company. The late Charles Sumner Bird held but little sympathy with the factory-built machine-made world. He kept far away from the ruts of misunderstanding and was quite certain that the secret of growth and success of Bird & Son, Inc., which progressed in forty years from a small factory to seven large plants was attributable to the fact that he and his associates saw the importance of recognizing the part played by the employee in a successful business.

The Bird plant was the first paper mill in Massachusetts to put into operation the three-four system, which provides three eight-hour shifts in lieu of two shifts of twelve and thirteen hours each, the making of paper being a continuous operation.

The executives of the company have devoted great attention in recent years to improvements and increased efficiency, all of which have made for largely enhanced production. A notable example is in connection with one roofing machine, representing an investment of perhaps \$100,000, whose production has been doubled in five or six years, due almost entirely to increased efficiency rather than to the expenditure of money, thus showing an advance in industry that cannot be measured wholly in terms of invested capital.

With capital of \$16,445,500, employing upwards of 1,800 operatives, President Philip R. Allen and his associates are carrying on the traditions of the founder of this internationally known manufacturing enterprise. Elmer H. Bartlett and George R. Wyman are vice presidents and Herbert H. Miller is treasurer.

The history of the Bird Machine Company dates back to 1908 when the late Hon. Charles Sumner Bird and Otto Wandel engaged in the production of rotary paper-machine screens, the business being incorporated the following year as the Wandel Screen Mfg. Co. In 1912 Mr. Bird purchased Mr. Wandel's interests, and four years later The Bird Machine Co. was incorporated, and is now engaged in producing special equipment for pulp and paper mills, the manufacture of rotary screens, both for paper-making and pulp-making, continuing to lead, and in addition a diversified line of paper-making machinery has been developed, including

the Pulmax Drive, a short center belt driving unit for general industrial use, and the concern also provides an engineering service.

It owns a modern, well-equipped machine shop, located in South Walpole, near the head of the Neponset River, is capitalized for \$839,000, and employs 150 operatives. Phillips Dennett is president, Ralph S. Clarke vice president, and Herbert H. Miller secretary and treasurer.

THE KENDALL COMPANY

The Kendall Company of Walpole constitutes a realization of a vision of management first contemplated by Henry P. Kendall almost a quarter of a century ago, when he foresaw the possibilities of building a cotton business which should control every process of manufacture from the raw cotton to the finished product, and, beyond that, should exclusively determine the merchandizing of the completed goods. These years have witnessed, one after another, the elimination of the spinner of yarns, the weaver of gray goods, the bleacher, the finisher, the commission man, and the selling agent, so that today, the concern is independent of outside production or externally created demand.

The products are marketed in the United States of America, and in Canada, and seventeen other foreign countries, under a registered trademark, which is recognized as identifying dependable goods. In the hospital field, where the bulk of the product goes, there is a market which is not subject to business depressions, does not suffer from inflation or deflation, is not seasonal, is steadily growing, and is strong, loyal and dependable.

Six branch offices are maintained in New York City, Chicago, San Francisco, Philadelphia, Cleveland and St. Louis.

The company owns and operates eight manufacturing plants, covering twenty acres of floor space, completely equipped with modern machinery, two being in New England, consisting of the finished plant, operated under the name of Lewis Manufacturing Co., at Walpole, and the converting plant, at Slatersville, R. I., employing altogether some 1,400 operatives.

The company acquired the factory and business of Bauer & Black, of Chicago, Ill., in 1928, consisting of a well-equipped and modern manufacturing plant producing gauze, absorbent cotton, adhesive plaster and similar productions which are distributed to drug stores by more than 130 salesmen.

In 1929, the Kendall Co. purchased the plant and assets of the Bike Web Manufacturing Co. of South Bend, Ind., engaged in the production of foundation garments sold by Sears, Roebuck & Co. and Montgomery Ward & Co. and of most of the athletic bandages marketed by nationally known sporting goods manufacturers and distributors.

The company operates five plants in the South—the Wateree Mills at Camden, S. C., the Addison Mills at Edgefield, S. C., The Thrift Mills at Paw Creek (near Charlotte), N. C., the Oakland Cotton Mills, and the Mollohon Manufacturing Co., both at Newberry, S. C. Altogether the concern owns and occupies a total of 1,800 acres of land at its five plants, affording ample room for future expansion.

The Lewis Manufacturing Co.'s plant at Walpole—one of the Kendall Mills units—with water rights on the Neponset River, is thoroughly modernized and especially equipped for bleaching and finishing absorbent



LEWIS MANUFACTURING COMPANY, WALPOLE



LEWIS MANUFACTURING COMPANY, WALPOLE

gauze, bandages, and surgical dressings, and for the manufacture of absorbent cotton. The Slatersville finishing mill, situated on the Branch River, is equipped for bleaching, dyeing, mercerizing, calendering, and finishing a wide variety of textiles. This plant has an excellent site with an abundant supply of water for industrial uses, as well as for a considerable amount of hydro-electric power of which about one-half has been developed.

The bleaching and finishing capacity at Walpole was greatly increased during the years between 1914 and 1918. Henry P. Kendall is president and treasurer, J. A. Valentine secretary and H. R. Lane vice president of the corporation, which is capitalized for \$5,600,709.

ANOTHER OUTSTANDING TWENTIETH CENTURY ENTERPRISE

In 1904, George D. Moore, professor of chemistry, at the Worcester Polytechnic Institute, organized the Multiple Triple Woven Hose & Rubber Co. and engaged in the manufacture of multiple woven fire hose and woven cotton belting. Four years later the word "Multibestos" was coined from "Multiple Woven Asbestos", and was first used and applied to asbestos brake lining. In 1911 the Standard Woven Fabric Co. was organized, with capital of \$400,000, to take over the business of the Multiple Woven Hose & Rubber Co., and at that time a small space was occupied in two buildings, in Worcester, the brake lining constituting but 5% of the total production. Indicating the importance of the automobile trade it is interesting to note that today the Multibestos Co. makes nothing but brake linings, and allied products, including clutch and transmission linings.

When 1913 rolled around the Worcester plant had been outgrown and land was purchased in Framingham, on which was built a factory of three stories, with a floor space of 50,000 feet and the capital stock was increased to \$470,000. While located at Framingham, the production of woven hose and belting was discontinued.

Continued rapid growth of the business made it apparent that the new factory would soon be inadequate for the company's needs. There was presented the choice of making additions or purchasing larger quarters. The second alternative was adopted and the plant that had been occupied by the Walpole Tire and Rubber Company, at Walpole, was purchased.

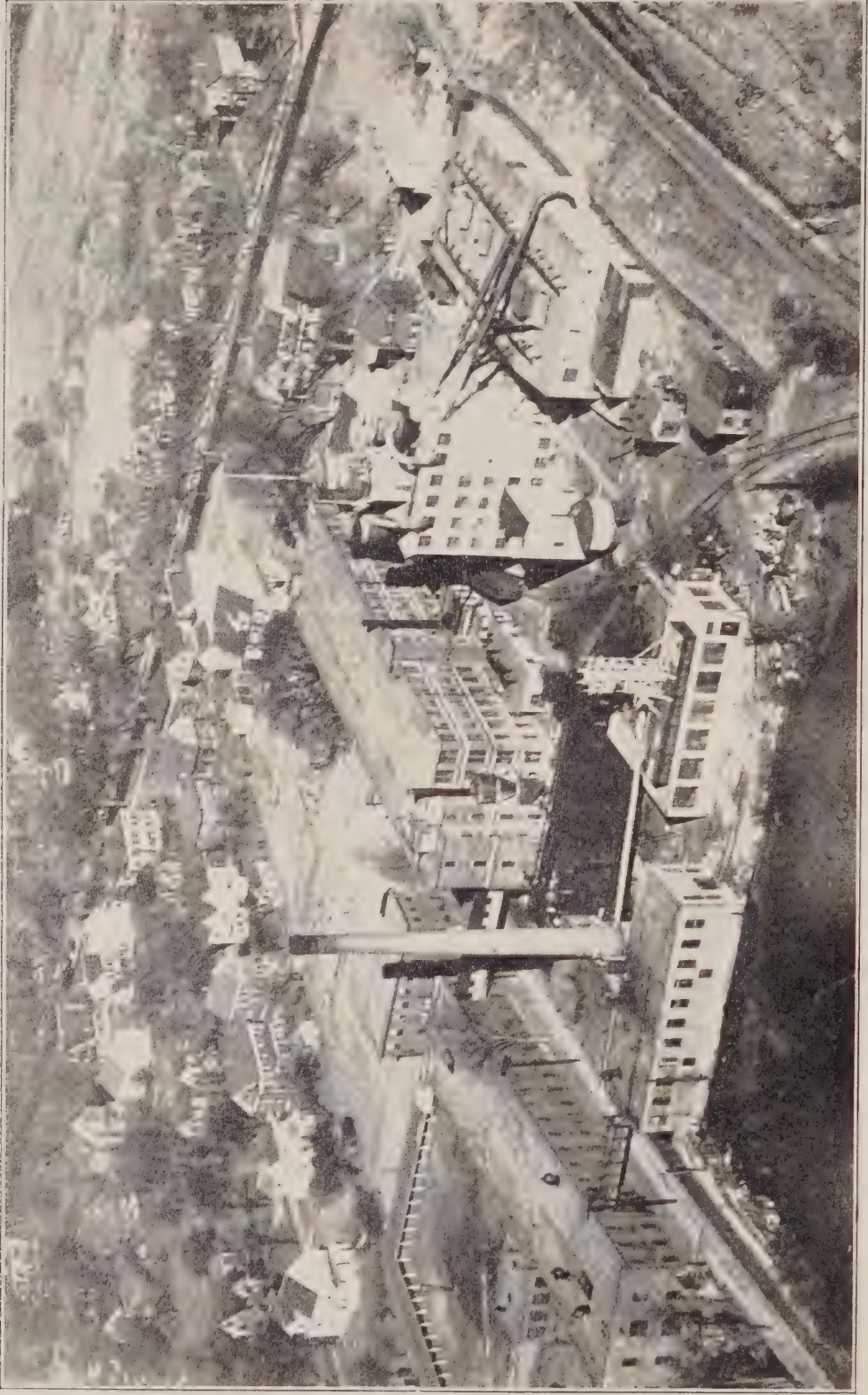
This property consisted of a number of buildings of modern mill construction and reinforced concrete, with a floor space of 175,000 feet and seventy-five acres of land. Installation of machinery in the new factory was made in 1916 and at that time the company's capital stock was increased to \$1,220,000.

By 1920 Multibestos products had become so well and favorably known in the trade that it was deemed advisable to make the name of the product more closely conform to the company name and the corporation was changed from Standard Woven Fabric Company to Multibestos Company.

The concern controls every process in the manufacture of its products, every operation being performed in the plant from the crushing of the raw asbestos to the inspection of the finished goods.

The company has made phenomenal growth in volume of sales since its organization and to-day is a strong, sound institution, highly rated, with an ample surplus and unquestioned financial stability.

Today, it employs upwards of 400 operatives, and in 1928 added a



AERIAL VIEW OF THE MULTIBESTOS COMPANY, WALPOLE

one story building of brick and steel construction to its modern plant. The present capital is \$1,488,314.

George Putnam is president, T. J. Daley, secretary, and C. W. Bunker, treasurer of the corporation.

ELIJAH SMITH'S NOTABLE INVENTION

The first machine for inserting wire into cotton, woolen and flax cards, was patented, in 1810, by Thomas Whittemore, but the real inventor was Elijah Smith, of Walpole. When Daniel Webster observed the device in operation he said that it seemed to be more nearly endowed with human intelligence than any other machine ever invented, while John Randolph, after looking at it in operation, exclaimed: "All but the immortal soul."

It seized the wire with its steel fingers, bent it, punched holes in the cloth, leather, or paper, inserted the wire at the rate of 190 teeth per minute, and automatically stopped if the slightest imperfection manifested itself.

In 1837, Smith Gray founded The S. Gray Company at Walpole, engaging in the bleaching and dyeing of cotton yarns and threads, and the concern today ranks as one of the oldest continuously operated textile units in Massachusetts, employing seventy-five hands in mercerizing yarn, and carrying on business under the original name. J. S. Leach is president and treasurer, and J. M. Gray, secretary of the corporation.

In the centennial year of 1876 the Walpole Dye & Chemical Works were established to manufacture turkey red oil, and at that period the junior member of the present-day firm of Bosson & Lane, of Atlantic, was superintendent of the Walpole concern.

The story of the Hollingsworth & Vose Company is carried in the chapter devoted to the manufactures of Middlesex County, as the concern operates a plant in West Groton as well as a mill in Walpole.

One of the six Massachusetts plants of the American Glue Company is located in Walpole.

Lewis F. Fales employs 200 operatives in the manufacture of machinery and iron castings; the Highland Lake Paper Company, with capital of \$80,000, manufactures builders' sheathing paper, G. H. Fitts being president, and J. P. Welsh, treasurer; the H. E. Plimpton Manufacturing Company employs forty operatives in producing automobile trunks, suit cases, and parcel post laundry cases, H. E. Plimpton being president and treasurer, and E. E. Pendleton, secretary; and the White Son Company, with capital of \$125,000, employs twenty in the manufacture of bookbinders' materials, and leather binder board, Carl F. Woods being president, Francis R. Sullivan vice president and secretary, and Gardner D. Pond, treasurer.

WEYMOUTH SPURNS THE THRICE OFFERED CROWN

Much is written and more is uttered by word of mouth these days concerning the alleged decline of industry in Massachusetts, and oftentimes those of the present generations come to believe that never before, in the three hundred years of manufacturing in the Bay State, have there been periods when so little attention was given to the continued development of industrial communities in our midst as at present.

But with all our reputed lack of intensive cultivation of new industries can anybody name a city or town in Massachusetts where, within the past

twenty-five years, attempts to locate new industries have been publicly frowned upon by the citizens of a community?

And yet a little over a hundred years ago three separate and distinct efforts to build the town of Weymouth into what today might have been a Lowell, a New Bedford, or a Fall River, were officially spurned by the voters of that municipality.

In the years 1822 and 1824 committees representing manufacturing enterprises made a careful state-wide survey of potential water power possibilities, with a view to selecting locations for well-financed industrial enterprises whose futures offered great possibilities, and after an exhaustive examination of available water privileges these committees un-animously agreed that the Weymouth Back River ought to be favored by them over all others that were visited.

On August 12, 1822, Samuel Hubbard and others associated with him, had so completely and definitely decided in favor of locating the enterprise they were interested in that they requested of the town the privilege of purchasing the alewife fishery—the only serious difficulty that lay in their pathway,—but the town, which valued a small income of a more or less ephemeral nature, that could then be measured in dollars and cents, more than a prospective large gain that could not be ocularly visualized, refused to grant the request.

Again, on April 5, 1824, General W. H. Sumner and a group of associates, impressed with the value of the water privilege on the Back River, offered the town \$200 a year for a period of ten years, agreed to build a satisfactory fishway whereby the hosts of the finny tribe could ascend the stream into the pond above; guaranteed to employ a capital at the outset of \$100,000 in the enterprise they wished to establish in Weymouth and to pay a parish tax to be equally divided between the three then existing churches in the town, if the municipality would grant them the right to use the waters of Weymouth Back River for power purposes. But again the voters of the town stupidly refused. Had wiser counsels prevailed Weymouth might well have been today the center of cotton production and perhaps a city of 100,000 souls or more.

On May 2, 1825, General Sumner renewed his offer, with a still more favorable proposition to the town, but on the day of its industrial Luper-cal it cast aside the crown for the third and last time, preferring to fritter away the hours of its citizens in coaxing up stream the itinerant alewives rather than to harness the town's potential assets into water powers that would have yielded over the succeeding decades so much in dividends of every kind.

The shortsightedness of the majority of the citizens of the town at that period is the more difficult to understand when one realizes that as early as 1641 Weymouth had a mill privilege owned by William Waltham; that at least as early as 1669 a tide mill, and a fulling mill, in 1693, with numerous grist, saw and other mills being set up in the seventeenth and eighteenth centuries, while the locality had long been engaged in ship-building activities. In 1771 iron ore was harvested from the bed of Great Pond.

But it appears that a dozen years later a new generation was in control of municipal affairs in the town for, when Nahum Stetson, who may be described as the Frick, Carnegie, Gary or Schwab of his day and genera-

tion, sought to put the power of Back River to work, he succeeded in his attempt. He was then operating the Bridgewater Iron Works, the Parker Mills at Wareham, and the Providence Iron Company of Providence, R. I., but he sought to conquer additional industrial worlds.

THE OLD EAST WEYMOUTH IRON COMPANY

In 1837 he headed a group which obtained a charter for an iron concern, known as the East Weymouth Iron Company, the machinery for which was built by Lazell, Perkins & Co., of Bridgewater. The iron company was originally capitalized at \$150,000 which subsequently was increased to \$300,000, and frequently in after years it employed as many as 275 men when operating at capacity. Started for the purpose of making boiler iron and nails, the former product ultimately was eliminated, and the manufacture of nails was exclusively carried on.

The success of the company was remarkable, as it developed a process of cutting the nails "with the grain" instead of across it, being the first concern to adopt this method.

The plant was located on Back River, on the line of the South Shore Railroad. Water power was used exclusively as the stream, with a fall of 66 feet, afforded an excellent privilege. The main building—the rolling mill—covered about an acre of ground and was equipped with six puddling, and five scrap and bloom, and four Lehigh furnaces, one heavy trip hammer, two hot and five cold shears, sixteen nail machines, suitable lathes, etc.

The machinery was impelled by five wheels, of which the largest was an overshot 40 feet in diameter, said to be the biggest wheel of its type in the country at that time. The others were 30, 28, 26 and 17 feet, respectively. A few rods below this main mill was a building with thirteen nail machines driven by a 17 foot wheel. Still further below was the forging mill, with two large trip hammers, one double and one single puddling furnace, and three open forging fires, all worked by three wheels. The lower mill, situated at the mouth of Back River, and at the head of tide-water, was equipped with fifty-two nail-cutting machines, driven by a 20-foot wheel. About half a mile distant, was a small mill, with eight nail-cutting machines. The company maintained a wharf, where vessels landed materials. Located there was a large store, store house and a nail-keg manufactory. The products of the concern ranged from the small, fine "three penny" nail to the seven inch spike.

THE STORY OF EDWIN CLAPP & SON, INC.

No part of the United States is richer in tradition than Massachusetts, and nowhere in this Commonwealth are the traditions more inspiring than on the South Shore—the very cradle of fine shoe-making in America.

It was here in Scituate, that James Sylvester Clapp was born in 1801, and where he started to make shoes at the end of his apprenticeship, in one of the little "ten footers," in which shoemakers plied their trade in New England a hundred and twenty-five years ago. It was here, too, that his son, James Henry Clapp, and later, his other son, Edwin, received their early instruction in the rudiments of what was destined to become their life's work.

Removing to Weymouth soon after the birth of Edwin, James Sylvester

Clapp found his business necessitated larger quarters than he was then using, and, in 1853, a small factory, two stories and a half in height, with a basement, was built by him, and soon afterward the firm of J. H. Clapp & Co., made up of the two sons, James H., and Edwin, was formed.

Upon the death of the former, in 1882, Edwin became the sole proprietor of the business, and abandoning the old factory, he erected a new and larger building, to which addition after addition was made. Compared with the present five story buildings, of modern construction, this second factory appears small indeed.

As a manufacturer Edwin Clapp was a genius, and in the days when the old fashioned leg boot was in vogue, he made a reputation second to none for the excellence of his product. When this style of footwear commenced to decline and the shoe began to replace the leg boot, he was one of the few who were successful in changing methods to meet the new demands.

He was one of the first Massachusetts manufacturers of fine shoes to abandon the custom of selling to the jobbing trade, and to substitute the policy of shipping direct to a selected line of retailers. Contrary to disastrous predictions, his judgment brought instant success, and afterwards, his example was followed by other factories.

Edwin Clapp was the first to use French kid and the first to employ patent kid in men's shoes, even though in adopting these courses he was opposed by all footwear authorities of the time who were in agreement that these leathers were too light for men's wear. He was also first to use electricity for power in place of steam.

For three-quarters of a century the Clapp factory has been located in East Weymouth and during all of this period has been owned by the same family through four generations.

The present plant is a model of light and cleanliness, thoroughly modernized in every respect. In 1901, Davis Bates Clapp, the only son of Edwin Clapp was admitted to the firm, which became Edwin Clapp & Son, Inc.

He died on September 5, 1901, in the twenty-fourth year of his age, and two years later Mr. and Mrs. Edwin Clapp erected the Clapp Memorial, in Weymouth, "for the purpose of perpetuating his influence and of continuing the interest he had in young men and his work in their behalf."

The memorial is an enduring expression of the wish of Davis Bates Clapp—young, vigorous, fond of athletics, interested in his fellow workers in the factory, and in his fellow townspeople, and who often expressed to his father a desire to establish an athletic field.

The building erected by his father and mother is a fully equipped gymnasium, with shower baths, bowling alleys, an auditorium, reception rooms, etc., and adjoining it is an athletic field of six acres.

At the Panama-Pacific International Exposition, held at San Francisco, in 1915, the Grand Prize Medal—the highest award conferred for men's footwear at that fair,—was presented to Edwin Clapp & Son, Inc.

Capitalized for \$400,000, the company employs 350 operatives in the manufacture of men's quality shoes. Horace R. Drinkwater is president; Edwin Clapp Lincoln, vice president, and William A. Hodges, treasurer and secretary of the corporation.

THE RISE OF THE STETSON SHOE COMPANY, INC.

In 1885, two young men, E. H. Stetson and A. C. Heald, conceiving the idea of making custom boots for the high-class jobbing trade, borrowed \$3,000, and started business in a small shop in South Weymouth, containing 9,100 square-feet, performing only the lasting and bottoming operation there, the uppers being cut and sent to nearby homes where they were stitched. A few years later, a larger plant and more capital were needed, and the firm of Stetson & Heald became the Stetson Shoe Company, being incorporated in 1900 under its present name The Stetson Shoe Company, Inc. Its present modern plant, containing 100,000 square feet of manufacturing space stands on the site of the original factory, and instead of the modest \$3,000 of capital it now has \$750,000 in capital, and a surplus of \$1,500,000.

Making only men's shoes at the beginning, its products became synonymous with quality and style. Then came the war and the resulting skyrocketing of prices, a situation which presented a serious proposition to the management. Should the company continue to maintain its regular standard of quality, and thus automatically be forced to raise its prices, or should it keep the figures where they were and cheapen the quality and workmanship?

Mr. Stetson died in 1914, and the highest courage and vision were required of Mr. Heald, upon whose shoulders rests the major part of the credit for the phenomenal growth of the concern. He decided to maintain quality at any cost, with the result that prices of Stetson shoes soared month after month until at the peak of high prices they were selling at retail for \$21.00. The wisdom of Mr. Heald's decision, however, was in the fact that at no time did the factory feel the effects of lost business.

Instead, the sales steadily gained until shortly after the war the plant was running full time and to full capacity. Even though the historical "slump" of 1920 and 1921, when shoe manufacturers, as well as others, were shutting up shop, the Stetson company rolled along with hardly a perceptible ripple in the smooth stream of business.

Some of the innovations brought about by the foresight of Mr. Heald, most of which are responsible in part for the success of the company, were the Foremen's Association, consisting of the foremen, executives and assistant foremen; the Mutual Benefit Association, of which practically every employee is a member; the Group Insurance plan under which the life of every employee is insured; and the profit sharing venture, or as it is more commonly called, the employees' stockholder plan, which was inaugurated in 1914.

These inside organizations served to create a feeling of loyalty and trust on the part of the employees to the extent that labor troubles have been conspicuous by their absence.

Shortly before the war production of women's shoes was started and the success of the "Snappy Tie" is well known throughout the entire shoe world, and gave the company acknowledged leadership among the women's welt manufacturers.

The management began national advertising back in the nineties, and followed this by direct mail methods, in 1898. Today, the company is the leading shoe advertiser using the up-to-date advertising medium of radio, the hook-up being national, comprising nineteen stations associated

with the National Broadcasting Company, and the programs being played every Sunday evening.

In publicity methods, the concern has since its beginning been a leader in the shoe field, its complete Style Show and Entertainment within the organization, the Stetson Shoe Snappy Revue, having attained an enviable position in the shoe world.

Always active in community affairs, the company made it possible for the Weymouth Post No. 79 American Legion Band to attend the Paris, France, Convention of the American Legion in September, 1927. This thirty-five piece band, many members of which were employees of the company, won third prize among all the bands at the convention, with the result that thousands of dollars of free publicity for The Stetson Shoe appeared in the daily press.

Early in its history, the concern decided to sell direct to the retail trade, and in some of the larger cities the problem of distribution could not be met save through the medium of shops for the exclusive sale of Stetson shoes, and today Stetson Shops, Inc., a subsidiary company, operates stores in all the larger cities of the United States.

Recently the housing problem of the employees became acute, and to take care of this contingency a building and loan association, called Rockcroft Company, Inc., was formed within the officials of the company, which organization builds houses for the employees at a low cost, arranges the financing, and makes it possible for the employees to own their homes.

The present officers of the company are Albert W. Little, president and export sales manager; Charles T. Heald, vice president and general manager; Albert Vinal, treasurer; Stanley Heald, vice president and factory manager; and E. T. MacBride, sales manager and director; Miss Hattie F. Gardner, assistant treasurer; Adolphus P. Poole, employees director, the above, with Wilton L. Hawes, constituting the board of directors. Upwards of six hundred operatives are employed.

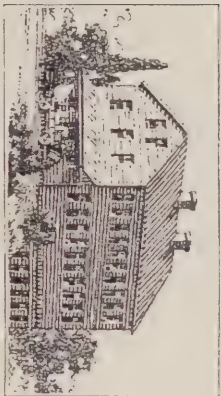
THE EAST WEYMOUTH WOOL SCOURING COMPANY

In 1887 the late John E. Mann purchased the plant and water privilege of the old Weymouth Iron Company, at East Weymouth, and established The East Weymouth Wool Scouring Company, which was incorporated in 1896, for \$50,000, and reduced two years later to \$25,000. A few years afterwards the business passed to the wool firm of Mauger & Avery, and, in 1901, to George H. Talbot, of the Norton Mills. The next year, Elmer E. Leonard, purchased a half interest in the concern, and in 1909 became the sole owner, an arrangement which continued for nine years, when his son, Bryan Leonard entered the business as assistant treasurer. In 1918 the capital stock was increased to \$50,000, and in 1928 was fixed at \$100,000. The mechanical equipment has kept pace with the increased business and the augmented capitalization.

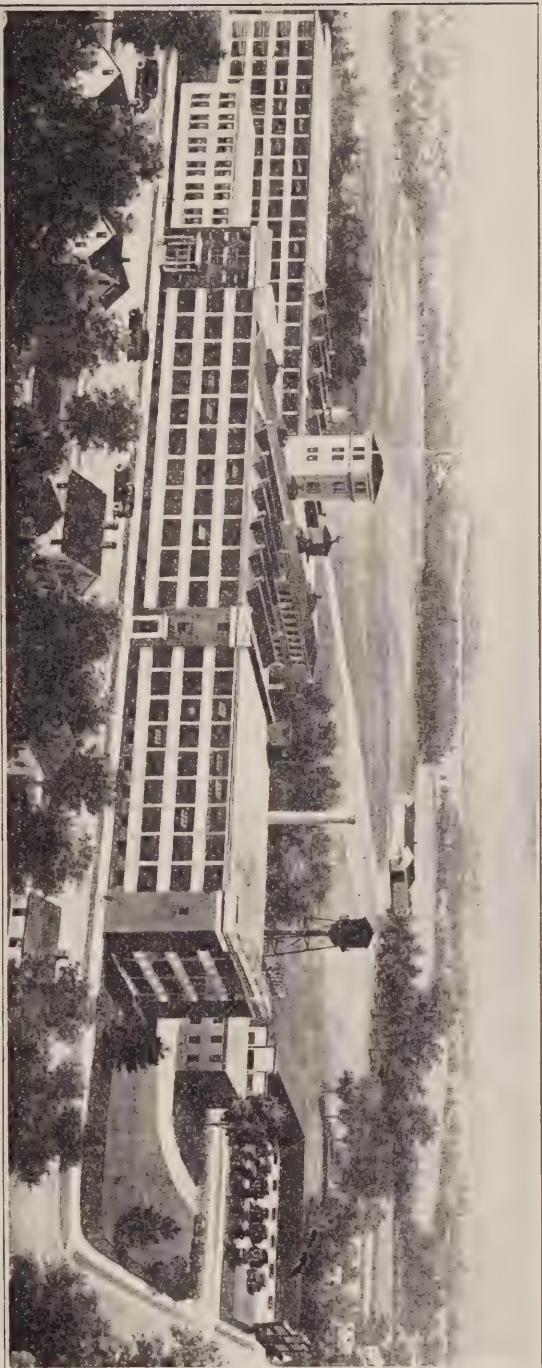
The present officers are Elmer E. Leonard, president and treasurer, and Bryan Leonard, vice president, and 145 hands are employed at the plant.

OTHER MANUFACTURING ENTERPRISES IN WEYMOUTH

For almost eighty years Weymouth has been the center of fireworks manufacture, Edmund S. Hunt having been the pioneer producer, starting,



THE FIRST SHOP OF THE STET-
SON SHOE COMPANY,
SOUTH WEYMOUTH



THE PRESENT PLANT OF THE STETSON SHOE COMPANY, SOUTH WEYMOUTH

in 1850, what today is known as the Edmund S. Hunt & Sons Company, which employs seventy-five operatives. Russell G. Hunt is president and Frank N. Clapp secretary and treasurer of the corporation.

The George H. Bicknell Company, Inc., with a capital of \$70,000 employs forty in the production of shoe counters, F. L. Bicknell being president and treasurer, and B. F. Tirrell, secretary.

Howe & French, Inc., operate one of their two Massachusetts plants, in Weymouth, the other being located in Everett. Capitalized for \$400,000 this well known drug and chemical concern is managed by C. P. Seaverns, president, and M. S. Thompson, secretary and treasurer. The Boston headquarters are at 99 Broad Street.

Pray & Kelly, consisting of William E. Pray and Joseph Kelly, employ forty operatives in the manufacture of paper boxes at East Weymouth; the Weymouth Art Leather Company, capitalized at \$229,000, employs sixty operatives in the production of artificial leather, George H. Lowe being president, and George H. Lowe, Jr., treasurer of the corporation; the Whitmore-Tirrell Shoe Corporation, with capital of \$100,000, employs 100 workers in the manufacture of children's and women's shoes, Walter J. O'Hara, being president, Guy C. Fletcher, vice president and general manager, Karl I. Tirrell, secretary, and Edward K. Whitmore, treasurer; The Stork Company, capitalized at \$100,000, with H. R. Brentlinger, president, and Harry S. MacDougall, treasurer, manufactures infants' goods; the American Agricultural Chemical Company, operates its only Massachusetts plant, in Weymouth; the A. O. Crawford Company, Inc., employs fifty at its South Weymouth plant in the manufacture of egg boxes, C. A. Scotcher being president and treasurer, and C. S. McWayne, vice president of the corporation; and the George Strong Company employs seventy-five operatives in the manufacture of men's shoes, the concern being owned by Jeremiah Fitzpatrick.

The George E. Keith Company operates one of its large plants in the town, and within the past decade Weymouth has become the center of the largest tide-water electric plant in the East—the famous Edgar Station, of the Edison Electric Illuminating Company of Boston,—into which millions of dollars have been poured.

The twenty-seven manufacturing concerns operating in Weymouth, in 1927 used stock and materials valued at \$6,513,568 employed 1,986 wage earners to whom were paid \$2,397,192 and made goods valued at \$12,603,101.

THE MANUFACTURES OF WRENTHAM

Wrentham witnessed the beginning of its industrial career, which continues to the present day, when, on June 20, 1793, Benjamin Shepard began the manufacture of fustians, cotton velvets and similar fabrics, the business having been continued by his sons, descendants and others for more than a century.

In 1801, the manufacture of straw bonnets was begun in the town, and in 1811, William Pond was granted a patent for woven straw plait.

Josiah Draper and John Tift, founders of the well-known firm of Draper, Tift & Co., of Wrentham, began the manufacture of jewelry at Attleboro in 1824 in a small shop on Ten Mile River. They continued operations there for about three years, and then removed to an old shop, formerly used for blacksmithing, and in 1832 erected a two-story build-

ing, 40 by 24 feet, with a one-story ell, 30 by 14 feet, about eighty rods north of Ten Mile River, and the following year admitted George W. Horr to partnership. Here they remained until 1841 when Joseph T. Bacon became a partner and the firm of Draper, Tift & Bacon was formed. That year a larger factory was erected on the other bank of Ten Mile River in Wrentham, and in 1854 Mr. Draper retired from the firm, the business being carried on by Frank S. Draper and Francis L. Tift, sons of the two founders, in association with Mr. Bacon and James D. Lincoln. The original Wrentham factory, three stories high, 100 by 35 feet, was enlarged in 1855 by the addition of another building, 75 by 20 feet, which enabled them to increase their facilities by a third. They then employed 150 men and women and utilized gas for lighting and soldering purposes.

A few years prior to 1843, George W. Shepardson, one of the pioneer straw goods manufacturers of Wrentham, began business in a small factory there, and in 1843, H. M. Richards opened a straw shop, and employed from twenty to thirty workers.

By 1884 the annual value of the local straw goods plants had reached \$250,000.

Prior to 1860, J. H. Sturdy & Co., began jewelry manufacturing at Sheldonville, and later removed to Wrentham village. In after years, Cowell & Hall were engaged in jewelry production in the town.

Other early industries were boot and shoe, shoddy, yarn and extract concerns.

THE WINTER BROTHERS COMPANY

At the dawn of the twentieth century, John E., Murray, and Charles C. Winter began the manufacture of dies, at Wrentham, and three years later The Winter Brothers Company was incorporated. These three brothers have spent their lives doing one thing—studying the problem of threading, which is everywhere regarded as a complex matter and yet an essential factor in the rapid advance of present-day mechanical civilization. Employing the analyses of the chemist, the experiments of the physicist, the investigations of the metallurgist, and undertaking thousands of tests in threading all sorts of metallic substances under every possible condition they have originated ingenious devices for measuring accurately lead, form, pitch diameter and relief; they have invented original instruments for determining hardness and torsional strength, and, fortunately, they have demonstrated their skill in interpreting the significance of these findings.

Located in a modern brick factory, on the Providence turnpike, the concern has made a real contribution to American mechanical productivity by keeping threading practice fully abreast of the requirements. Employing 175 hands, and with capital and surplus of \$600,000 the company takes rank as one of the outstanding industrial enterprises of Norfolk County. It maintains its own stores in Chicago, Cleveland, Detroit, Buffalo, Pittsburgh and New York.

J. E. Winter is president, Murray Winter, vice president and mechanical superintendent, John H. Woodhull, secretary, and Milford E. Bliss, treasurer.

The company publishes *Timely Tape*, a little magazine devoted to tapping problems. Explanation of these difficulties are made by practical shop men in the employ of the concern for interested industrial

executives. The demand for dependable and accurate threaded holes in nuts and machine parts, increases by geometrical ratio, the automobile, airplane, every electrical device, and the tools to manufacture these commodities depend for their very existence upon many accurately threaded parts. Thousands of new alloy steels developed since the war, have frequently demanded special technique to facilitate threading, and this need has been cared for by the Wrentham concern.

THE MANUFACTURING STATISTICS OF 1927

In 1927, the 462 manufacturing concerns of Norfolk County produced commodities valued at \$156,369,466, used stock and materials valued at \$78,428,234, and employed 22,813 wage earners to whom were paid \$30,-277,806, in wages.

Of the total number of concerns, 158 were located in the city of Quincy, and employing 5,461 workers, to whom were paid \$8,245,228 in wages, there were produced commodities valued at \$23,400,798.

Norwood's twenty-four industries came second, 2,753 employees being carried on the payrolls, receiving \$4,048,168 in wages, that year, and manufactured goods valued at \$25,261,803, were produced.

Next in order came the sixteen industries of Walpole, whose products were valued at \$23,349,188, with 1,833 employees to whom were paid \$2,677,884, in wages.

Braintree's twenty manufacturing concerns ranked fourth, the value of the products being \$13,738,163, and the number of employees, 1,503, to whom were paid \$1,729,253, in wages.

Weymouth's twenty-three industrial concerns produced goods valued at \$12,603,101, and carried 1,986 employees on their rolls, to whom were paid \$2,397,192, in wages.

The rank of the other towns was as follows:

	No. of Establish- ments	Average No. Wage Earners	Wages Paid in 1927	Value of Products
Stoughton -----	26	1,367	\$1,697,870	\$ 9,018,377
Canton -----	18	1,135	1,245,247	7,565,514
Franklin -----	23	1,109	1,441,447	7,372,554
Foxboro -----	10	609	777,555	3,256,228
Needham -----	26	679	706,401	3,092,785
Plainville -----	6	559	719,345	2,198,859
Dedham -----	15	462	516,253	2,094,842
Wellesley -----	15	117	195,182	1,941,627
Brookline -----	25	419	463,123	1,891,084
Medway -----	8	458	560,456	1,618,194
Randolph -----	9	252	279,880	1,227,001
Milton -----	5	21	29,891	145,061
11 other towns---	31	2,090	2,547,431	16,596,287

WHEN, WHERE AND BY WHOM SHOE MAKING BEGAN
IN MASSACHUSETTS

- 1635—Lynn—Philip Kirtland and Edmund Bridges
1785—Westminster—Bezaleel Baker
1795—Milford—Colonel Ariel Bragg
1795—Haverhill—Andrew Greely
1796—Leominster—Benjamin Hawes
1800—Braintree—Samuel Hayden
1800—Weymouth, Marblehead and Medway—Pioneers unknown
1805—Medford—John Hosmer
1808—Georgetown—Pioneer unknown
1810—Northbridge—Pioneer unknown
1811—Leicester—Josiah Green
1811—North Bridgewater (now Brockton)—Micah Faxon
1813—Worcester—John Tyler Hubbard
1815—Newburyport—Thomas Emerson
1816—Stoughton—John Linfield
1816—Hudson—Daniel Stratton
1816—Spencer—Josiah Green
1819—Millbury—John Goddard
1820—Stoneham—Warren Sweetser
1824—Pepperell—John Walcott
1825—Fitchburg—Elijah Dickinson
1827—Natick—Asa Felch
1830—Sutton—Pioneer unknown
1830—Peabody—Pioneer unknown
1832—West Brookfield—John N. Fales
1834—Abington (now Rockland)—Jenkins Lare
1834—Wenham—Amos Gould
1835—Marlboro—John Boyd
1836—Walpole—John Mann
1840—Ashland—Calvin Dyer
1845—Southboro—Messrs. Newton & Hart
1845—Shrewsbury—Jasper S. Nelson
1850—Danvers—Pioneer unknown
1855—South Abington—M. S. Reed

CHAPTER XLVII

THE PART MASSACHUSETTS HAS PLAYED IN THE INVENTION OF SHOE MACHINERY

In the inception and adoption of labor-saving methods by which leather is wrought with facility into the myriad of forms that now employ so much of the productive capacity of the State, more rapid progress was made in Massachusetts in the nineteenth and twentieth centuries than in any of her sister commonwealths. The fertility of the inventive resources of Massachusetts men resulted in a contribution to the reputation for ingenuity, dexterity and versatility in the shoe and leather industries, not only characteristic of this Commonwealth, but indicative of the fact that in all types of machine production improvements have been devised and ingrafted upon the original mechanisms which continue to this day.

It is significant that in the evolution of the gigantic industrial offspring of the shoe industry of America—the United Shoe Machinery Corporation—substantially all of the genius which produced it came from the loins of Massachusetts.

It was in Boston that Benjamin F. Sturtevant finished his pegging machine, which he had conceived in Maine; it was in a Cambridge attic that Elias Howe, born in Spencer, built the first model of his sewing machine, and, incidentally, in the same city, that Isaac Merritt Singer, began his experimental work on the device that bore his name, and upon which he was forced by the courts to pay royalties to Howe for pirating the basic patent; it was in Cambridge, too, that Col. Gordon McKay lived in the days of his triumphs, while in the nearby town of Winchester he centered his metallic-fastening interests; it was the South Abington cobbler, Lyman R. Blake, who produced the machine for sewing soles to uppers that attracted McKay's attention on Boston's famous Tremont Row; it was his brother-in-law, Robert H. Mathies, another Massachusetts inventor, who invented the rotary horn still in service as a McKay machine feature; it was J. M. Estabrook, a youthful Milford machinist, who invented and patented the automatic clinching machine that was absorbed by the McKay interests; it was D. C. Knowlton, a Boston shoe manufacturer, and O. R. Chapin, an expert machinist of the same city, who invented the machine that produced shoe nails with tapering wedge-shaped points, which was taken over by McKay; it was Henry S. Cushman, a Milford harness maker, H. S. Bacon, Andrew Eppler, Jr., William Duchemin, Willard Comey, Edward E. Bean, William Wickersham, all of Boston, Charles W. Shippee, of Milford, H. F. Nason of Cochrasset, Charles W. Glidden of Stoneham, Horace H. Bigelow of Worcester, Henry A. Henderson of Lynn, and scores of other Massachusetts inventors, who created almost uncanny machines that contributed to the creation of the McKay companies; it was Christian Dancel, who, in 1874, produced for the Goodyear Company the first practical machine of the Goodyear type, which would sew shoes with a welt, after the manner in which they

could be sewn by hand; it was Louis Goddu who was responsible for the Northampton pegger, the cable wire machine, and standard screw machine; it was Seth Tripp who invented the beveling machine; it was the little Lynn immigrant, Jan E. Matzeliger, who conceived and patented the device that is most human-like in its operations of all the shoe-making inventions—the lasting machine, the greatest of the series, upon which the upwards of 2,600 changes made by the old Consolidated Hand-Method Lasting Machine Company, and the United Shoe Machinery Corporation, required the expenditure of more than \$1,500,000 before the product was declared 100 per cent efficient, in 1904, and lastly, it was the stupendous energy, the creative ability, and the broad industrial vision of that master of men, Sidney W. Winslow, a native of Brewster, on Cape Cod, that harnessed all of the above, and many other important inventions into one harmonious whole, and made possible the phenomenal development of the United Shoe Machinery Corporation, a quarter of a century ago.

And yet there exist in certain quarters those who say Massachusetts is asleep industrially, but, happily, the twentieth century story of this single industry gives the lie to the carping critic, and the progress made in this field is but typical of that which has taken place in widely diversified manufacturing lines where Massachusetts still leads the world.

It seems desirable to sketch in this chapter the contributions made by sons of Massachusetts to shoe machinery development, rather than to allude to them in the sections of this work devoted to the stories of the industrial progress of the cities and towns where they lived and acted, and in view of the importance of the South Shore of Massachusetts in the field of American shoe production it is appropriate to carry the story as a preface to the histories of the internationally known footwear concerns centered in Plymouth and Norfolk counties.

THE MAGNITUDE OF SHOE PRODUCTION ON THE SOUTH SHORE

The so-called Brockton district ranks as the greatest shoe-producing center in the United States, the seventy-seven boot and shoe concerns, exclusive of rubber, located in the cities and towns of Plymouth, Norfolk and Bristol counties, having manufactured, in 1927, products valued at \$79,560,004, while seventy-seven additional establishments in the same three counties, engaged in manufacturing boot and shoe cut stock and findings, produced commodities that year valued at \$19,529,954, or a grand total of \$99,089,958. Of the total value the plants of Brockton alone produced \$38,027,028 worth of boots and shoes, or nearly fifty per cent of all that were manufactured, in the three counties of Plymouth, Norfolk and Bristol.

While the North Shore towns are pre-eminent in tanning, currying and finishing leather, having produced in 1927 commodities valued at \$40,840,308, in eighty-one plants located in Peabody, Salem, Lynn, Haverhill, Danvers, Beverly, and three small towns in Essex County, the total value of the boots and shoes manufactured in 273 plants in that county was \$71,804,614, or \$7,755,390 less than the value of the footwear manufactured that year in the South Shore section of Plymouth, Norfolk and Bristol counties. Adding the value of the boot and shoe cut stock and findings manufactured in 227 plants in Essex County, in 1927, which amounted to \$28,378,691, the total value of boots and shoes, cut stock

and findings reaches the imposing total of \$100,183,305, or \$1,093,347 greater than the totals in the Brockton district.

Lynn and Haverhill rank as the two great shoe-producing centers of the North Shore district, but the total value of the footwear manufactured in the former city, in 1927, was but \$26,696,393, as against a value of \$38,027,028, in Brockton, that year, while in Haverhill there was produced, in 1927, footwear valued at \$26,020,438. Brockton, therefore, takes rank as the greatest shoe-producing city in Massachusetts.

The tanning, currying and finishing of leather in Plymouth, Norfolk and Bristol counties amounted in value, in 1927, to \$6,937,297.

Bristol, Essex, Norfolk and Plymouth together manufactured in 1927 boots and shoes, exclusive of leather, valued at \$151,364,618, produced boot and shoe cut stock and findings valued at \$47,908,645, and tanned, curried and finished leather valued at \$47,777,605, making a total of \$247,050,868, or very close to a quarter of a billion dollars.

THE STURTEVANT PEGGING MACHINE

A little less than three quarters of a century ago, Benjamin Franklin Sturtevant found his way to Northbridge, in this state, and thence back to Skowhegan, Maine, in both of which towns he worked, until 1856, at pegging shoes, and became, without having served an apprenticeship, a skillful artisan. He had injured his health by the confining work of the bench and he began casting about for some occupation that would improve his condition. It was then that he dreamed a dream. In his mind's eye he saw the possibility of a machine that would shave a continuous ribbon of wood from a log—as tape is unwound from a spool—and, feeding this strip to a cutter, would form each peg from the wood and drive it into the shoe at the same blow. That was his vision, but he had no knowledge of mechanics and he was devoid of experience in constructing machinery. He had, however, learned what was being used in making footwear by the hand method, how many pegs he must be able to drive, and how rapidly the work must be done by a machine, if it was to find a market. After pondering on the subject for a month, he succeeded in producing a crude and imperfect model, which embodied all the primary principles of the modern pegging machine, and in 1856, at the age of twenty-three years he left Skowhegan and came to Boston, with seventy-five cents in his pocket.

It was the irony of fate that what seemed to be his principle asset—the seventy-five cents—he was obliged to spend for cab fare in order to transport his bulky model to a lodging house.

It was in Boston that he finished the invention, protected it by patent, and gave to the world a device that has pegged the shoes made in every civilized land in the Sturtevant way.

To induce a capitalist to guarantee him a small sum each week, while developing the machine, Mr. Sturtevant assigned to his financial backer one-half of the patent absolutely, and the entire control of the remaining half, an arrangement which proved highly beneficial to the money lender, inasmuch as the inventor never received any money return from his device.

During 1857 and 1858 he was engaged in building five experimental machines, upon which three patents were taken out, and the ensuing two years were utilized in perfecting his first attempts. In 1859 the owner

of a worthless patent, granted in 1854 for a pegger, having examined the Sturtevant machine, claimed an infringement, and artfully convinced the capitalist who had aided Mr. Sturtevant of the validity of his claim, with the result that the latter, in 1860, stopped Mr. Sturtevant's weekly stipend, just on the eve of success, and left the inventor penniless, but not without resource to draw upon his fertile mind.

Up to 1860, when the Sturtevant pegging machine and its co-worker, the sole sewing machine, were introduced, not more than half a dozen power shoe plants were in existence. These two inventions gave birth to the New England shoe-factory system, which has grown to be one of the largest industries in the country and they exerted an influence upon 200 other patented shoe machines for the equipment of a complete establishment. From 1860 to 1880 an average of 30,000,000 pairs of boots and shoes were each year pegged upon the Sturtevant pegging machine, with an annual saving to the public of over \$1,000,000.

Mr. Sturtevant soon saw that the success of his device depended upon its having a suitable supply of material and that an exhaustless series of pegs contained in a narrow strip of wood veneer could alone meet this want. No machine for cutting such veneers with a knife was in existence, and to do this successfully, without shattering the wood, was considered impossible. He next invented the wood-veneer lathe, by which not only the peg strip is cut and turned, but also veneers of a thousand shapes and forms, from the bulky barrel stave down to the delicate slices of ornamental woods, which, when glued to paper, are employed in the external finish of all fine woodwork, and for interior decoration. To gain the required length of peg strip, Mr. Sturtevant conceived the plan, in 1859, of cutting a spiral ribbon from around a log across the grain and after a week's labor with a common lathe and a rude spring, to control the log, he succeeded in obtaining a fair specimen.

Later he built a lathe that turned out, unvaryingly, a perfect peg-veneer; but it was not until he supplanted the rude spring attached to his first machine by the well-known presser-bar. He was granted patents in 1861 upon both the veneer-cutter and its product, the veneer, and a re-issue was given him in 1875. The peg-wood lathe seized a peeled log of white birch, 18 inches long, and with great rapidity turned out a spiral veneer, which at the same instant was divided into ribbons as wide as the length of a peg, and from 50 to 100 feet long. These ribbons were then dried, beveled on one edge, uniformly compressed and toughened by machines which were invented by Mr. Sturtevant, and were fed from rolls, into which they were wound into the pegger in much the same manner as thread is wound into a sewing machine.

THE WHITTEMORE INVENTION

While there are conflicting claims as to who originated the shoe pegging machine, and while almost unending litigation followed its introduction, the preponderance of evidence seems to clearly indicate that Amos Whittemore, produced a working machine for pegging shoes, in 1833, when but a youth of nineteen years. In a room of his mother's home, in West Cambridge, he labored for six weeks making patterns for the parts, the iron work being done at a neighboring blacksmith shop. Whittemore was jealous of his undertaking and kept his experiments so closely concealed that some of his prying neighbors, with characteristic curiosity, effected

an entrance to the house, and bored holes through the floor of the room above that in which the machine was in process of formation.

On December 12th of that year, he declared it finished, and calling in his mother and sisters, James Russell, Henry Whittemore, and the blacksmith and his assistant, placed a shoe in position, and turning the crank, effected the pegging expeditiously and neatly. Not entirely satisfied with it he attempted to add appliances for buffing, hammering and trimming the sole, and after pegging a dozen pairs of shoes for his friends, he moved the machine to Woburn, in the spring of 1835, where, because of the customary threats of workmen who informed him they would mob him and smash his device, he set it up in a private room in Dr. Cutler's residence, bought leather, fitted the uppers, and pegged about forty pairs of shoes. For Alfred Putnam & Sons, of Danvers, he pegged about 150 pairs, but still the hand shoemakers, with their traditional opposition to labor-saving devices threatened to burn down any factory that installed the machine, while the women refused to sew the bindings on any shoe pegged by the device. The sons of Alfred Putnam favored the use of the machine, but the father, less courageous and prejudiced against all machinery, carried the day, and Whittemore went to Boston, but failing to receive encouragement, returned to Woburn, where Samuel B. Richardson agreed to build a factory, and install the pegging machine.

He erected a shoe shop, but being actively engaged in other enterprises, gave little attention to his new venture and after 150 pairs of shoes were pegged, Whittemore became disgusted, boxed up the machine, took it back to West Cambridge, where it remained stored in a carriage house for twenty years, until it was set up in the Boston office of David Whittemore, and was destroyed in the famous Boston fire of 1873.

Amos Whittemore had never applied for a patent on the device, giving as his reason that he was discouraged because he could not interest manufacturers in its use, and that he never felt financially able to incur the expenditure incident to securing patent protection. His attitude was held to constitute an abandonment of such rights as he might have had.

In 1835, Samuel Preston, of Danvers, was granted a patent on a pegging machine, but there seems to be no record of its being employed, and, in 1851, Charles D. Bigelow, of Worcester, received a patent on a similar machine, which was in use for many years thereafter.

By 1870 a dozen patents on pegging machines had been granted, and after 1863, when the McKay machine came into general use with a sewing method that cost less than pegging, there arose a lively interest in pegging devices, many inventors seeking to perfect the primitive and crude models of earlier years, and thus supply serviceable, efficient and economical machines.

On December 15, 1857, William Wells, of Danvers, was granted a patent on a pegging machine, and by the following year had thirteen in operation, eleven of which were installed in Massachusetts factories.

Seth D. Tripp had assigned to Edward L. Norfolk, of Salem, a patent on a pegging machine, granted to him on April 12, 1853, and, in 1858, Benjamin Franklin Sturtevant, of Boston, obtained his patent on a machine, which was later taken over by Elmer Townsend, of Boston, who hired Sturtevant, John J. Greenough and Joseph F. Sargent, who also held patents on pegging machines, to act as expert machinists in an endeavor

to perfect the device then on the market. On October 11, 1864, Sargent was given a patent on an improved machine, but about a month before that William R. Landfear, of Hartford, Conn., had been granted a patent on a similar machine, which he had assigned to David Whittemore, of Boston.

Three machines, known as the New Era, the Champion and the Varney were marketed, the first being practically the Sturtevant invention, using the peg wood stock he designed, and which was then controlled by Townsend.

The fundamental feature of the New Era pegging machine was the peg strip, which has never been superseded in the intervening years. The beech wood used was calendered by a device attached to the machine, which insured a uniform degree of thickness, when the strip was cut into pegs.

The Champion and Varney machines embodied the Landfear invention, and were controlled by Whittemore. Each manufacturer claimed certain advantages, but the Sturtevant machine was faster and was generally preferred in most factories. Then followed long years of costly litigation, which financially ruined some of the participants.

The outcome of it demonstrated the fact that Benjamin Franklin Sturtevant's peg wood strip was really the key to the solution of the pegging machine problem. He had previously invented the method for cutting the strips from the circumference of logs by a continuous motion, the strip or sheet being shaved off or unrolled apparently from the surface of the log.

This process now so universal in veneering work was sold by Mr. Sturtevant, for a comparatively small sum, but he reserved the right to employ the method in making shoe peg strips. These strips can be cut to any desired thickness, the width being the length of the peg, one edge being trimmed off, wedge-shaped, for the points. Without this type of a peg strip it was found that no machine was capable of satisfactory work.

Another essential feature to the success of the pegging machine which was added to the Sturtevant peg strip was the method of compression—also an invention made by him. Employing the other devices, the pegs were loosely driven and were liable to shrink and not hold as well as when hand-pegging was resorted to, but with the compression of the peg strip, the pegs once driven, filled the holes, and subsequent swelling made them hold even firmer than when a shoe was handpegged.

The combination of the pegging interests, following the litigation, resulted in three types of machines being offered the trade, differing somewhat in mechanism and speed, one of them being the Sturtevant model, having a daily capacity of 900 pairs of shoes per day. The cost of pegging—four to six cents per pair for hand work, was reduced to fifty cents per case of sixty pairs by the machines.

The public demand being for sewed shoes, pegged work began to dwindle in the seventies, and almost disappeared after 1880, when it was superseded by the metallic fastening methods. But Sturtevant and associated inventors had demonstrated the workability of a machine-pegger, which retired all other similar devices from the market. By this

method the pegging was done upon the shoe-last, and years later John F. Davey perfected a horn-pegging device.

Sidney W. Winslow and his associates adopted the fundamental advantages of the Sturtevant and Davey machines, and refined them into the products of the United Shoe Machinery Corporation, so that pegs can now be split and driven at the rate of 350 per minute.

BLAKE'S INVENTION, WHICH ULTIMATELY BECAME THE MC KAY MACHINE

The machine-made shoe had its beginning when Elias Howe's eye-pointed curved needle, operating with an under shuttle, was perfected, and it was his invention that inspired a generation of inventors to devote their attention to leather stitching.

The application by the boot and shoe trade of Howe's basic patents to the machine sewing of leather and the adaptation of it by J. B. Nichols had so advanced when King Edward VII of England came to the throne that he regularly ordered Lynn-made shoes for himself and the Royal family.

Lyman R. Blake, reared in the shoe-making town of South Abington, now Whitman, was one of the first to realize that if a sewed sole could be manufactured at approximately the cost of the pegged or nailed type, there would at once develop a correspondingly increased demand for such a product, and while employed as an expert operator on the Singer and the Townsend sewing machines, in the Gurney & Mears factory, he conceived the idea of adapting the machines for sewing the soles.

At that time, sewing through leather was easily performed by the machines using the single waxed thread chain stitch, but the problem confronting Blake was to provide a working arm inside the shoe to carry the thread, and execute a stitch around the toe. He devised a hollow arm or horn, tapering to a small rounded end, and carrying mechanism for effecting a loop of the thread, which was caught and drawn through the sole to the outside by the hooked needle, that penetrated the sole from the upper arm.

Whittling out a model, he engaged a wheelwright to fashion one of better appearance, and after adding some refinements to the original, he had cast iron parts made, and finally set up the machine and operated it. Blake immediately secured patents on the method and the machine, these being granted July 6, 1858, and, in 1861 or 1862, a number of the devices were set up in William Porter & Sons' factory, in Lynn, being operated by foot power, as steam had not entered shoe plants at that period.

Blake's invention probably did more to modernize shoe manufacture than any other contribution of his day and generation. Lacking financial resources, he negotiated with Edgar M. Stevens, of Chelsea, to pay \$50,000 for the patents, \$10,000 of the amount to be in cash. The latter sought the advice and aid of Joseph B. Crosby, a Boston patent lawyer, who, in turn, consulted with Col. Gordon McKay, a tenant in an adjoining office. McKay was a man of considerable means, a skilled engineer and machinist, formerly the manager of a Lowell machine-shop, and possessed an extensive acquaintance in the shoe trade. He had not completed his investigation of the Blake invention before the date of the expiration of Stevens' option arrived, and as the terms were not met, the inventor offered his patents to Messrs. Hubbard and Houghton, for the same figure he had agreed to sell the patent to Stevens.

Blake had installed one of his machines in a cobbler's shop, on Tremont Row, in Boston, and Colonel McKay intently watched through the window the operation of sewing soles to uppers. Becoming convinced that the device represented a distinct advance over the then existing methods of shoe production, he consulted with Messrs. Hubbard and Houghton, and learning that it was impossible for them to make the payment demanded under Blake's option, he agreed to provide the money. An offer of \$70,000 was made to the inventor, \$8,000 of which was to be paid in cash, and the remaining \$62,000 out of the earnings of the machine, the arrangement being that Blake should receive \$50, on each machine sold, and a royalty of two cents on all shoes produced thereon, until the total balance of \$62,000 was reached. The agreement also covered such subsequent inventions or improvements as Blake might provide relating to sole sewing machinery. McKay afterwards faced seven years of litigation, at an expense of \$15,000 when a group of Lynn manufacturers unsuccessfully attempted to establish the Stevens claim to the first option for the purchase of the Blake patents.

McKay had granted Messrs. Hubbard and Houghton, and J. B. Crosby, each a fifth of the invention, retaining two-fifths himself, and for three years devoted all of his time toward perfecting the machine, in which work he was aided by Crosby and Robert H. Mathies, the latter a skilled machinist and inventor, and, during that period he turned out seven or eight machines of different kinds, manufacturing 150,000 pairs of shoes for the United States Army on one, in order to test out its efficiency on heavy work. McKay had become liable for expenditures of about \$130,000 in connection with the machines, and at the end of the second year of experimentation, all who were interested with him, save Houghton, advised him to abandon the enterprise rather than risk further losses, while Hubbard sold his fifth to McKay, in 1861, for \$1,800. That year, Blake joined with McKay in perfecting and improving the invention, his primary activities being in instructing users of the machine how to successfully operate it and in introducing to manufacturers the new system of shoe production, which really involved an entire reorganization of most concerns.

The original Blake machine was much like an ordinary sewing machine and operated on a table. The lower arm was inclined upwards from the table base, on a curve and tapered to the small end which carried the thread looper. The arm being rigid proceeded along each side of the shoe to the toe, but it could not cross the latter. As the shoe could not turn upon this arm, the first essential improvement was to devise a plan that would enable the horn to turn upon a spindle, thus enabling the point to follow the toe inside the shoe. This form of horn, coupled with a method devised for heating the waxed thread as it passed through, contributed the essential features that made the machine a success.

Blake's health began to fail about this time, and the work of devising the rotary horn, which superseded the original stationary horn that sewed only the sides, leaving the toe and heel to be nailed, devolved upon his brother-in-law, Robert H. Mathies. During Blake's absence in the south in quest of a restoration of his vigor, Mathies completed his important contribution to the machine, and as he had conceived the device it was referred to as the Mathies horn.

An iron frame, standing nearly six feet in height, and weighing some 500 pounds, superseded the table, and on August 12, 1862, patents were granted on the improved machine. Eight years later further improvements made in the mechanism of the horn looper increased the capacity of the machine to 600 pairs of shoes a day.

The Blake leather stitching machine, perfected under the direction of McKay by the addition of the Mathies horn, and refined later by the experts of the United Shoe Machinery Corporation, is still a primary factor in the production of shoes.

The McKay stitcher rapidly gained in favor and soon outran the pegged shoe method. For a few years part of the finishing was accomplished by hand, but the inventors of the United Shoe Machinery Corporation simplified the mechanism and speeded up the McKay product until today it produces 1,260 pairs of shoes a day.

McKay and his associates devised methods for cutting a channel in the outsole, in which the line of stitching was carried, the flap being turned down and cemented to cover the stitching, thus presenting a smooth finish on the bottom of the shoe. Special machines for this performance were devised by Mathies and formed a part of the McKay machinery outfit.

Having improved the Blake machine to his satisfaction, McKay created the McKay Sewing Machine Association, with a capital of \$250,000 and adopted the royalty system in marketing the device.

Undoubtedly, the Civil War, gave an impetus to the Blake and McKay machine, that it would not have gained for many years had ordinary conditions prevailed. Many of the old shoemakers, who were opposed to the use of machines in general, and who would have fought the McKay products strenuously, were in the Union Army. There arose an urgent demand for shoes to supply the troops, and the manufacturers were eager to avail themselves of any device that would speed up production.

The first improved machine was installed in a Weymouth factory, in June or July, 1861, and was used in making army shoes. The following year, Colonel McKay secured a contract for 2,000 shoes for the War Department, and gave the work to Gilmore Brothers, of Raynham, famous inventors of shoe machinery, and the owners of the only factory then capable of turning out an order of that size.

By the end of 1863 about 200 McKay machines were in use, and they had stitched 2,500,000 pairs of shoes. Showing the growth in eight years, 25,200,000 pairs were stitched by the machines in 1870.

Seth Bryant, one of the pioneer shoe manufacturers of this state, who had located at Joppa, in East Bridgewater, in 1822, was one of the early users of the McKay machine, and soon after the Civil War began went to Washington, where he interviewed Secretary Stanton, of the War Department, who examined the samples shown him by Bryant, which had been stitched on the McKay machine. He expressed doubt as to whether machine sewing could be depended upon for the rough usage of the army, whereupon Mr. Bryant agreed to warrant the wear and to stamp his name on every pair of shoes supplied, if the Government would insist on other manufacturers adopting this course. Regulations to that effect were issued, and before the end of the war, Bryant had supplied more than 300,000 pairs of shoes to the government, while upwards of fifty per cent of all the footwear used by the War Department during the war

came from the plants of Massachusetts manufacturers using the McKay machines.

In 1872, the Blake patents were renewed for seven years, on petition of practically every user of the machines. After 1880 the royalty system was abandoned, and the machines were sold outright, the manufacture and distribution of them passing to a subsidiary organization, known as the Stanley Manufacturing Company. F. F. Stanley, president of the corporation had been an employe of McKay's, and had invented an important improvement to the McKay machine, known as the Stanley horn, by which the shape was changed from a straight arm to one having an upright base, with a curve at an angle of about forty-five degrees near the point, thus making it easier to turn it in the shoe. Stanley also introduced steam heat, which proved more uniform, and he so placed the wax pot in the horn as to enable the dry thread to pass through the wax as required.

In 1865, Blake went abroad to look after his foreign patents, but due to inaccuracies in the description prepared by his agent who had secured the protection, they earned for him only about \$23,000—an insignificant portion of their real value. The device as used in England, France and other European countries is known as the Blake machine, rather than the McKay product.

When Blake applied for the extension of his patent, in 1872, he conservatively estimated that 200,000,000 pairs of shoes had been sewn on his machines, at a saving of eighteen cents per pair over the cobbled type, or a total of \$36,000,000, not including the increased wages that had flowed to shoemakers, and yet his total emolument up to that period had been but \$145,000, plus the receipts from his foreign patents, and his wages from 1861 to 1872. When the extension of the patent was granted, Blake received \$166,000 from his stock holdings in the McKay concern, and \$200,000 additional from the company under the terms of his contract. He had worn himself out in prosecuting the invention and he died October 5, 1883, at the age of forty-three years, and in his death the shoe industry lost a genius. Wherever shoes are made in factories his invention is in use today, and the benefits to shoemakers and consumers cannot be expressed even in billions of dollars.

Following the Civil War, Colonel McKay attacked the problem of nailing shoe soles and his name is identified with the introduction of the first pair, either stitched or nailed by machine, that came into general use.

From 1876 to 1880 Charles Goodyear, Jr., and his welt and turn shoe method and Gordon McKay with his Blake patents, and metallic fastenings for bottoming shoes, were in conflict, and the two geniuses spent much of their time in the courts attempting to establish their respective rights, but in the latter year there came an amalgamation of the two interests under the name of the Goodyear and McKay Association, and fifteen years later, the McKay companies were sold to the Goodyear shareholders, a consummation which had been devoutly hoped for by every shoe manufacturer, and which proved to be the salvation of the industry.

At that time, the McKay system possessed the ability to stitch a pair of women's shoes in thirteen minutes, using forty-two machines which executed fifty-seven different operations. After the experts of the United Shoe Machinery Corporation had added the refining touches it became possible in building a shoe of extreme fashion such as a Polish Goodyear welt, with perforated vamps, foxings, outside panel, eyelet and stays,

to perform as many as 210 operations. Of this total 174 were cared for by 155 different machines, and the remaining 36 by hand. The average Goodyear welt shoe is the product of a string of from about twenty-five to forty machines.

THE ESTABROOK, KNOWLTON AND CHAPIN CONTRIBUTIONS

When the so-called "French Screwed Boots," made in San Francisco began to attract attention in the east, a Le Mercier machine was brought from the Pacific Coast to Milford, where J. M. Estabrook, a youthful machinist of that town, began experiments with the wire, and found that by driving pegs cut from the threaded wire and clinching them, they held as firmly as when screwed in by the machine. On December 29, 1868, he received a patent covering a threaded nail or peg, and the firm of Estabrook, Wires & Co., was formed, to manufacture threaded pegs, or clinching screws, the latter being made with wedge-shaped points, which provided a firm clinch on the inner sole, when driven against an iron-bottom last. Subsequent patents were granted to Mr. Estabrook covering the shape of point, heads for the nails, and machines for their manufacture, and in 1880, a machine for driving the screws was brought out, which was improved by patents granted on February 28, 1882. That year, the Clinching Machine Company succeeded the original Estabrook concern, and ultimately a machine was perfected that automatically cut the proper length from a coil of threaded wire, and clinched the screw. The new company was soon absorbed by the McKay Metallic Fastening Association.

D. C. Knowlton, of Boston, a shoe manufacturer of twenty-five years experience, addressed himself to the problem of metallic fastening, and, in 1879, obtained a patent for a shoe nail made of soft brass in the form of corrugated wire, with a section cut from one side, which produced a nail with a tapering wedge-shaped point, flat on one side and corrugated or threaded on the other, the full thickness of the wire forming the head.

With the assistance of O. R. Chapin, an expert machinist, Mr. Knowlton built a machine, which cut a section from the corrugated wire by a scissors-like motion, and drove the remaining tapering nail through the sole, the tapered point being clinched on an iron last, and the wire cut off smoothly on the outsole surface. Later, a horn support was substituted for the iron last, the flattened end of the horn serving to clinch the nail. Another machine was evolved by Knowlton for tacking outsole in place preparatory to sewing or nailing by other machines, and the Flexible Shoe Nail Company was formed to put the devices on the market. This company was acquired by the McKay Metallic Fastening Association, and the improved taper nail, tacking machines, arranged with a single or double head are largely in use today in many shoe factories.

THE CUSHMAN, BACON AND EPPLER INVENTIONS

Henry S. Cushman, a Milford harness-maker, was among those who early gave attention to devising a process for a metal covered waxed thread, and appreciating that a length of thread could not be hardened sufficiently to be driven, he secured a patent on November 18, 1875, for a thread covered with a thin sheet of brass.

In 1882, H. S. Bacon, of Boston, invented a machine for covering the thread by soldering over the brass strips, and the Union Fastening Company was formed. Andrew Eppler, Jr., became interested in the idea, and

after working with Mr. Bacon for about five months a set of machines was completed for covering and driving the thread, patents upon which were granted on February 27, 1883, and August 14, 1883. These were assigned to the Union Metallic Fastening Company which succeeded the original concern, but while the process was endorsed by practical shoemakers they did not look with favor upon the introduction of a product so entirely different from anything then on the market.

EPPLER'S WELT AND TURN SEWING MACHINES

In 1891, Andrew Eppler, Jr., who had been employed in David Whittemore's shoe machinery plant, at Wollaston Heights, later as superintendent of mechanical work in the Goodyear Shoe Machinery Company, in Boston, and afterwards by the Union Metallic Fastening Company, introduced the Eppler Welt Machine and following the expiration of the first Goodyear patents, he jointly invented and produced the Eppler and Adams turn sewing machine, which he further developed for a welt sewing machine, which differed in some respects from the Goodyear product, but accomplished substantially the same results. He formed the Eppler Welt Sewing Machine Company, in Boston, in 1891, with strong financial support and with fairly good success. A system of auxiliary machines was developed including a welter, stitcher, rough rounder and outsole channeler, welt beater, welt splitter, welt groover and beveler, and an insole lip turner. Mr. Eppler died at North Weymouth, April 1, 1902.

DUCHEMIN'S AND COMEY'S INVENTIONS

As early as 1871 efforts were made to adopt the McKay machine to turned shoes, and William Duchemin, of Boston, a skilled machinist, conceived the idea of stitching a turned shoe through the sole on a machine with a horn similar to the McKay device, the horn point following a channel in the bottom of the sole, and on the inside before the shoe was turned right side out—in one sense reversing the McKay method, which followed the channel on the surface of the outsole. Securing a patent for turned shoes produced in this way, on June 24, 1873, and on an improved machine, on July 28, 1874, the Boston Turn Shoe Association was formed, but it developed that the horn arm feature was an infringement on the McKay patents, and legal complications prevented the use of the Duchemin machines.

Willard Comey, who was interested in the Turn Shoe concern, believed that the Duchemin invention could be adapted to sewing welts, and he constructed an entirely new machine upon which he obtained a patent, and another for shoes made by the process, on December 13, 1881, the Duchemin rights being bought as a measure of protection. The Improved Sole Sewing Machine Company was organized in 1881, to manufacture and market the new machines.

SHIPPEE'S STITCH-DOWN METHOD

About this period, Charles W. Shippee, of Jones & Shippee, of Milford, began experimenting on a stitch-down method, making use of a double sole, the first corresponding to the regular inner sole. The edge of the upper was turned outward and stitched to the innersole, and a second stitching was then made through the two soles. In this manner, the

seam holding the upper was protected from wear until the outsole wore away. The method, which became known as the "double seam stitch down," provided a comfortable shoe for heavy lines, though lacking in style. A patent for the process was secured by Mr. Shippee on April 11, 1882.

WICKERSHAM'S HOOKED NEEDLE

William Wickersham, a Boston machinist, was granted a patent on April 19, 1853, on a hooked needle for catching a waxed shoe thread, which drew it up through the leather in the form a crochet loop, and produced a single thread chain stitch—the basic patent for nearly all the waxed thread sewing machines that subsequently appeared in the shoe machinery field.

Selling his rights to the invention to Butterfield & Stevens, of Boston, then engaged in producing shoe machinery, they manufactured the devices for a time, ultimately disposing of the Wickersham patent to Elmer Townsend of Boston, who also bought the patent granted to William Butterfield, on July 4, 1854, covering an improved machine; another received by Sidney S. Turner, on August 22, 1854, and one issued to Joseph W. Lyons, of North Brookfield, in December, 1858, on similar machines. He introduced the Townsend, or New England machine, which was manufactured in Boston by Townsend, Mallard & Cowen.

When Col. Gordon McKay developed the Blake sole sewing invention, he learned that the hooked needle was an infringement on the original Wickersham patent, and he was forced to pay a royalty of \$25 on every McKay machine during the life of the patent.

Townsend controlled the production of waxed thread machines, holding assignments of some forty patents on these devices, as well as numerous patents on pegging machines and other shoe machinery. The Townsend and Union Machines, the latter made under license from Mr. Townsend to David Whittemore, controlled the field up to Mr. Townsend's death, in 1871, when his interests and those of Whittemore were merged into the Shoe Machinery Manufacturing Company.

In 1869, the Consolidated Wax Thread Sewing Machine Company, was organized, in Boston, operating under license from Townsend for the use of the Wickersham needle and other basic patents, which were attached to an improved machine invented by Edward E. Bean, who had been associated with David Whittemore.

A. F. Johnson had been granted a patent for certain improvements on the sewing machine, on April 12, 1864, and Bean's patent granted December 5, 1865, these two grants forming the basis of the new concern. From October 1871, to July 1875, the company manufactured 566 machines.

In 1879, the Townsend, Whittemore and Bean interests were combined in the National Wax Thread Sewing Machine Company, and a new machine was devised, which embodied all the desirable features of the previous products, and was generally used on all types of waxed thread sewing where a chain stitch on one side was desired. It came to be regarded as the standard machine for leather work of all kinds, including harness and glove making, until it was early superseded by the lock stitch, waxed thread machines which produced the smooth stitch on both sides.

H. F. NASON'S MODIFICATION OF THE CHAIN STITCH

On May 4, 1880, H. F. Nason, of Cochituate, in Wayland, patented a modification of the chain stitch on wax thread machines. The Nason machine inverted the stitch, bringing the chain loop below instead of above, thus adapting it for sewing counters and similar work. On April 7, 1882, he built and patented another machine, with the loop stitch below, which was adapted for stitching outsoles. The machines were manufactured by David Whittemore, and continued in use until displaced by the lock stitch type of a later era.

THE GLIDDEN AND BIGELOW HEELING MACHINES

When Col. Gordon McKay had developed his sewing machine to a point where it was yielding satisfactory returns, he turned his attention to a heeling machine, that would supplement the sewing and finish of the sole, and about 1870 he organized the McKay Heeling Association.

The first successful heeling machine had been invented by Charles W. Glidden, of Stoneham, who was induced to enter the employ of McKay. About the same time Horace H. Bigelow, of Worcester, was experimenting on the heeling machine problem, and evolved a process for moulding the heels into the desired shape, loading them with the nails partly driven, and attaching them to the shoe with a final driving of the nails. Organizing the Bigelow Heeling Association, the two units clashed until 1875, when they were merged into the McKay & Bigelow Heeling Machine Association. Later improvements were contributed by Mr. Bigelow, and the machines soon came into general use.

Soon after McKay introduced his heeling machine, Henry A. Henderson, of Lynn, invented a heel trimming machine, which he patented, in 1882, and formed the National Heeling Machine Company.

THE STELLAR INVENTION—MATZELIGER'S LASTING MACHINE

In December, 1872, Colonel McKay, Charles W. Glidden and James W. Brooks purchased all the patents controlled by the American Lasting Machine Company, and proceeded to develop a new device. The McKay Lasting Association, organized for this purpose, spent over \$120,000 in experimental work, in securing patents, and in acquiring the rights held by Henry G. Thompson, of Hartford, Conn., in this field. Ultimately the McKay group took over the Copeland Lasting Association and formed, in 1881, the McKay & Copeland Lasting Association, which controlled over 100 patents on lasting machines.

But the shoe industry was anxiously awaiting in these earlier days of the mass production of shoes the arrival of the inventive genius who could substitute metal digits for adept human fingers in pulling over the upper on a last and in bottoming a shoe.

The existing devices while representing an advance were far from practical and efficient and it was in the lasting operation that the least advance had been made in machine operation. In the solution of this important problem, resort was again made to a Massachusetts genius.

Despite the fact that many inventors and expert machinists, with ample financial backing were engaged for long years in attempting to evolve a practical, economical and successful lasting machine, it remained for an obscure young man, of foreign birth, working alone and without

financial resources other than his own meager earnings, to invent a mechanical device which, in practically all essentials was an innovation and which proved infinitely superior to all that had preceded it.

Jans Ernst Matzeliger was born in Dutch Guiana, South America, the son of a well educated native of Holland, who had been sent to Dutch Guiana by his government to assume charge of important construction operations. There the senior Matzeliger married a woman of native Indian blood. At the age of ten years, Jans Matzeliger, the result of this union, was placed at work in the government machine shop, where he developed a natural aptitude for mechanics, and served an apprenticeship. His father believed greater opportunities awaited the son in the United States, and the young man spent some years here in study and in traveling, and, at the age of twenty-five, entered the employ of M. H. Hervey, as a McKay sole sewing machine operator.

Interested in the processes, he conceived the idea of inventing a machine that would sew turned shoes, but he changed his mind when he heard some of the lasters employed with him in the shoe factory of Harney Brothers, in Lynn, make the boast that whatever else might be accomplished by machinery the day would never dawn when hand lasting would be superseded by machine operation.

Fortunately for the shoe consuming public of the world, he had not acquired the hatred for machines which then obsessed the operators in footwear factories, and which, in the city of his adoption, had resulted in a series of pitched battles that drove many local manufacturers out of that city or out of business. It was not until the local lasters' union had been so crippled by its enormous expenditures in carrying on the fight against the introduction of machinery methods, and had alienated so many thousands of its members who longer refused to pay dues to a group of obstructionists, that it finally gave way to the modern method of making shoes.

Jans E. Matzeliger particularly resented the statement of the lasters that no inventor could substitute iron for human fingers in lasting a shoe, and he began to observe closely the motions of the hand lasters and to study the mechanical method of imitating them. Securing a room over the West End Mission, in Lynn, where he was safe from prying observers, and delicate in health, he worked night after night on the problem, cut off from companionship with his hostile factory mates. Having no capital beyond his wages, he was forced to use such materials as he could find, and with a few boards, some old cigar boxes, and a handful of nails he worked on a rough model of his lasting machine for the better part of six months, until he had succeeded in mechanically imitating the motions of the hand laster. His attempt to carry on his work secretly was thwarted, and many who had learned that he was building the model, came to his room only to laugh at the unusual combination of sticks moving in the form of a machine. He was ridiculed and warned of the failures of others who had attempted to invent lasting machines, and was reminded of the opposition likely to come from well-financed companies manufacturing shoe machinery. Few had words of encouragement, although one visitor, who had tried without success to evolve a lasting machine offered young Matzeliger \$50 for his model—an amount which he later admitted tempted him.

Once he found his wooden model practical, he obtained some castings and parts of old machines, and with these he forged, filed and fitted the parts, and finally, in September 1880, at the end of four years, a machine that would actually work was produced.

This second model, rough and primitive though it was, resulted in an offer of \$1,500 for that part of the device that pleated the leather around the toe of a shoe, and he decided to accept it, but later recanted as he felt that if it was worth that figure to somebody else it was worth more attached to his machine. Modeling a third machine, the plan was sent to Washington, but it was so crude in workmanship that it was not until an expert was despatched to the Patent Office to explain the working of the machine that the department officials found it possible to protect the invention by issuing a patent.

In testing the device, on regular work, Matzeliger found many improvements were possible. While he secured his first patent in 1882 he continued his work until he had produced an entirely new machine, greatly simplified and improved, which he patented, in 1884, when the Hand Method Lasting Company was organized to manufacture and distribute it.

Not entirely satisfied with its operation, Matzeliger continued to make further changes until he became unable to work by reason of ill-health, and he died of tubercular trouble, in September, 1889, at the age of thirty-nine years, leaving as his enduring monument the greatest contribution of all time to the shoe machinery field.

The importance of the lasting machine to the industry is attested by the fact that the daily output of the shoe laster of the olden days rarely exceeded sixty pairs, while the perfected machine, running as one unit in a chain of machines, "pulls over" from 700 to 1,000 pairs a day, according to the type of footwear upon which it is engaged, by means of its five almost uncanny iron fingers which carefully, firmly and without hesitancy adjust the upper to the last, while, at the appointed instant, another device tacks it ready for welting and soling until the onlooker is obsessed with the belief that the operator gently caressing the machine now and then with his human digits, has unconsciously imparted to the dynamo which operates it the magic power of life and even human thought.

The merits of Matzeliger's invention were instantly recognized by shoe manufacturers, and while opposition to its use was aroused by the hand-lasters, who contemptuously referred to the device as "The Nigger Head Machine," because it had been produced by a swarthy complexioned alien, with crinkly hair and in whose veins flowed Indian blood, it steadily grew in favor and ultimately was taken over by the United Shoe Machinery Corporation, which added many improvements to it.

The story was long current in Lynn that the lasters ascribed to the machine human fingers that worked with human intelligence, and that it actually talked, the sounds emanating from it when in operation falling on the ears of the lasters in the words: "I've got your job. I've got your job."

The catalog of the United Shoe Machinery Corporation pays a tribute to the pioneer mind of Jans E. Matzeliger, when it states that the principle of the machine remained unaltered throughout its entire development.

Among its special merits are the operations of the pinchers for pulling the upper, which by a cam movement positively close and do not tear the most delicate types of upper leather. No better method of handling loose

tacks for fastening the upper to the sole has yet been invented than appears on the Matzeliger machine, and the twist and the pull of the pinchers reproduce with exact precision the dexterous and almost eerie skill with which an expert hand laster treats difficult upper leather in lasting a shoe.

No other machine in the world is capable of manipulating and shaping a shoe on all styles of lasts, and today it is practically impossible to make shoes to meet present commercial requirements without resorting to the use of the Matzeliger invention.

In the little Cape Cod town of Brewster, there was born in 1854, five years before Gordon McKay bought the Blake patent—which event was the real beginning of the shoe-machinery era—Sidney W. Winslow, the son of a South Shore shoe maker and inventor. The father had abandoned the work bench for machine-sewing, and it was young Sidney's good fortune to live long enough to witness the passing of the old hand methods and the triumphs of the new day in the shoe industry. At the age of thirty-five years he invested in the stock of the company formed to market Matzeliger's lasting machine, and employing experts to complete the Lynn inventor's device, it was so perfected as to render increased efficiency, but it was not until 1904 that the "puller-over" was developed, and for seven or eight years afterward constant changes and refinements were added.

No less than 2,600 changes were made by the old Consolidated Hand-Method Lasting-Machine Company, and by the United Shoe Machinery Corporation, at a cost of nearly \$1,500,000, before the machine was declared 100 per cent. efficient.

THE KNOX SOLE CUTTING MACHINE

Due to the inventive genius and perseverance of David Knox, who began business as a machinist, in 1855, at a time when the factory system of producing shoes was looked upon as a doubtful experiment, much of the machinery now considered indispensable in a plant, is to be attributed.

Knox originally turned his attention to the invention of a sole cutting machine. Devices for cutting strips into sole blanks were made by Richard Richards and George Foster, of Lynn, and John Thompson, of Marblehead, in 1844, but neither did satisfactory work and after much experimenting Knox produced a machine, upon which he obtained a patent on May 5, 1855, the device being provided with cutting knives attached to different beams, with lever arms which swung down alternately and cut the two sides of the sole blank. It also did away with the former method of wetting the leather before cutting it, and the machine could be so adjusted as to allow one pair of knives to cut different sizes of soles from different widths of sole leather strips.

Knox next directed his attention to the development of a sole moulding machine, which he placed on the market, in 1860, and which undoubtedly influenced the popularity of the McKay sewed shoes more than any other single device. The sole moulding machines of today embody the primary principles of the original Knox invention.

His next contribution was a moulding machine for shaping counters, or heel stiffenings, and subsequently he contributed many valuable improvements to other machines of which he was not the original inventor.

He also invented the process known as the Knox morocco finishing and pebbling machine, which came into general use in leather production.

THE MASSACHUSETTS IDEA OF TRADE-MARKED SHOES

In 1866, at a period when helpful invention was in its infancy; when Morse's telegraph was but recently placed in operation; when Bell had not perfected the telephone; when Edison was an adolescent youth; when Marshall Field had just migrated west to establish the greatest retail business in the United States; when the application of steam to industry was in the bud; when railroad travel was slow and transatlantic voyages were time consumers, and at the time the Atlantic cable was being laid; when processes were crude and conditions following the Civil War were chaotic; when shoe production was painfully slow, and efficient machinery was entirely lacking; when the itinerant shoemaker was omnipresent and when methods of distribution were inadequate,—the middleman or jobber being the dominant figure in what limited production was in vogue—the Massachusetts idea of trade-marking shoes was born, and the individuality of the manufacturer was forever established.

SOLE CUTTING, CHANNELING AND OTHER MACHINES

In 1870, Jason Smith, of Rockland, who had already invented a machine for dieing out leather in small pieces for ornamental work, conceived the idea of developing a machine for rounding out and channeling the sole at one operation, and upon which he was given a patent on March 23, 1880, the device being marketed under the name of the Smith Sole Fitting and Channeling Machine.

D. F. Hartford, of Hartford Brothers, of Boston, was granted a patent on April 3, 1883, on a sole rounding machine that could be adapted to different sizes at the will of the operator. It was further improved and a second patent was issued to him on December 30, 1884.

Andrew Eppler, Jr., was given a patent on a sole laying machine in February, 1882, which he assigned to the Boot and Shoe Sole Laying Company, a corporation that manufactured and marketed the device.

J. B. Johnson, of Lynn, received a patent on November 25, 1867, on the American Beating Out Machine, and the partnership of Swayne, Fuller & Co., was formed to manufacture the invention. Later, additional improvements were made and the machines were constructed with six lasts mounted in a form, with pressure applied from power shafting, and under the name of the Swayne, Fuller & Co. Leveler, it was patented on July 20, 1880, and became generally used in shoe factories.

O. Gilmore, a boot manufacturer at Raynham invented a leveling machine, with a radically different idea than was embodied in Johnson's device, and obtained a patent in 1880. Manufactured by the Carver Cotton Gin Company, it was marketed as the Gilmore Leveler, and in 1884 radical improvements on it were patented by Mr. Gilmore, and it was sold as the Combination Leveler, being adapted to either wooden or iron lasts, and to sewed, pegged or metallic fastened soles.

In 1868, S. D. Tripp, of Lynn, invented another style of beating out machine, which was further improved in 1883, when it was marketed as the Little Giant Leveling Machine, and being capable of great speed, it soon found a place in many factories.

In 1884, Morris B. Bresnahan, of Bresnahan Brothers, shoe machinery

manufacturers of Lynn, was granted a patent on a leveling machine in which the pressure was applied laterally, instead of downward.

BUZZELL'S EDGE TRIMMING MACHINE

J. H. Buzzell, of Boston, invented an edge trimming machine, in 1877, which was a vast improvement over any existing device, and which trimmed the edge and the top simultaneously, and the Buzzell Trimming Company organized with \$300,000 capital, sold 200 machines during the first two years after the concern was formed.

Later, Mr. Buzzell acquired license to the patents granted to A. J. Johnson, of Rochester, N. Y., on a trimming machine, made important changes in the device and obtained a patent for an improved arrangement of the guides and the action of the cutter, on July 11, 1882, as well as one covering an improvement in its construction, and, in July 1883, formed the Buzzell Manufacturing Associates to manufacture and sell the machines. This new concern took over the original Buzzell patents, and two subsequent issues granted on July 3 and July 11, 1883, and secured the right to use the Orcutt cutter, invented by W. D. Orcutt, and the William Manley patent.

Mr. Buzzell was granted two additional patents on improvements on July 16, 1883 and November 18, 1884, which resulted in his calling in all the original machines and installing remodeled devices in their stead.

J. Wesley Dodge patented in 1884 another style of trimming machine known as the Dodge trimmer, and formed the Dodge Trimmer Company, that year to manufacture the device.

OTHER IMPORTANT CONTRIBUTIONS TO THE FACTORY SYSTEM

Freeman Winslow, of Salem, secured a patent in 1875 on a new method for cleaning or buffing the soles of shoes, and formed the Naumkeag Buffing Machine Association, which later owned some twenty-five subsequent patents covering improvements on the original idea, one of the most important of which was secured in 1896, when the device became known as the Naumkeag Pneumatic Sole Cleaning Machine.

The Globe Buffer Company brought out another idea for buffing the soles, in 1881, and later placed on the market a heel scourer.

Dr. George H. P. Flagg, a practising dentist in Boston, organized the Union Edge Setter Company, and a twin setter manufactured by it proved a great success in the bottom finishing field. Later, he formed another company for the manufacture of the Globe buffers and heel scourers and for preparing the moulded sandpaper to cover the scouring wheels, while, in 1899, he became interested in the Boston Lasting Machine, which was subsequently sold to the Consolidated Hand Method Lasting Machine Company.

J. Wesley Dodge, inventor of the trimming machine, which bore his name, became interested in the development of edge setting by machinery and, about 1872, made material improvements on the Hodges Machine, then being manufactured by the Shoe Machinery Manufacturing Company, employing a rotary tool, introduced by C. S. Fifield, at that time engaged in the machinery business in Boston. For some years, the Dodge machine ruled the market in its line. In 1875, Mr. Dodge constructed another machine, with a modification of the rotary acting tool, but this

was put aside until 1884, when William Gordon suggested changes in it and the device afterwards came into use as the Gordon Edge Setter.

In 1858, before the McKay machine came upon the market, a heel burnishing machine was patented by Elias F. Ingalls, of Lynn, and in 1863 and 1864, B. R. Budding, of Worcester, manufactured several machines for the same purpose. V. Q. Spear, of Lynn, brought out improved machines in 1867 and 1869. About the same period, Messrs. Hawkins and Mead, of Boston, produced some machines that promised good results and Philip P. Tapley of Lynn, a prominent tanner, formed the Tapley Machine Company, for the purpose of combining the interests of the Ingalls, Spear, Hawkins and Mead inventions, and ultimately the Tapley Heel Burnishing Machine was developed.

EYELETTING AND TREEING MACHINES, AND LASTS

By 1871, Elmer Townsend, of Boston, had purchased thirty-seven patents on eyeletting machines, including those of Messrs. Reed, Packard, J. Keith, Joseph F. Sargent, one of his employees, N. Ames, J. E. Gowens, L. Hall, E. Shaw, and others, and following Townsend's death, David Whittemore, of Boston, came into possession of them, and continued the manufacture of eyeletting machines which embodied substantially the design patented by Mr. Sargent, and known as the Monitor.

William S. Landfear, who was associated with Whittemore, patented a machine, in 1874, for the manufacture of eyelets, these materials having been imported exclusively up to 1864.

J. Howe, of Milford, was granted a patent in 1848 on an improved treeing machine, and twenty-five years later when factory work had grown by leaps and bounds he revived his idea and constructed an improved machine upon which he received a patent July 9, 1874.

A. B. Shumway, of Worcester, brought out a similar machine about the same time, which was later declared to be an infringement on the Howe idea.

In 1878, O. A. Miller, of Rochester, N. Y., who had purchased a patent on an improved treeing machine designed by Robert Turneure, of that city, moved to Brockton and began the manufacture of the Miller Treeing Machine. In 1884, A. D. Tyler, one of his foremen, provided an essential improvement to the device and the Miller product enjoyed wide distribution in the shoe machinery field.

As early as 1815 Thomas Baldwin, a citizen of the Bay State invented the first lathe for turning wooden shoe lasts, and in 1845, John Kimball, of Boston, was granted a patent upon an important improvement in lasts, which consisted of a block attachment for varying the width sizes with the same bottom.

THE MORLEY AND MATHISON BUTTON SEWING MACHINE

In 1878, James H. Morley was a sewing machine agent in Holyoke, and one day while conferring with a shoe manufacturer to whom he was trying to sell some machines, the latter remarked in a jocular way, "What you want to invent now is a machine for sewing on buttons and then we will be fixed."

Morley had never entertained the idea of becoming an inventor, but the chance remark grew upon him and he began studying the problem of sewing buttons by machinery. He found it would be easy enough to pass

a needle through the shank of a shoe button and make a stitch that would hold the button, but this method was no improvement over hand sewing. He realized that the buttons must be fed to the needle, and spaced off automatically at proper distances. For two years, he experimented on a machine which finally executed all the required motions, and upon which he obtained his initial patent. But he was not satisfied with the results, and between 1880 and 1884 he was granted fourteen additional patents, and in the latter year formed the Morley Button Sewing Machine Company, to manufacture the machines.

Joseph Mathison, of Lynn, was granted two patents on January 10 and January 28, 1882, on a button machine and formed the Standard Button Fastening Machine Company, and subsequent changes made in the device were patented on November 28, 1882.

Kasmir Vogel and D. W. G. Humphrey, of Chelsea, experimented before the Civil War on a machine for making buttonholes, and, in 1862, the latter secured a patent on an automatic buttonhole machine, and the Union Buttonhole Machine Company was organized the following year.

In 1871 he produced a new type of machine, which differed from the first in the feed mechanism and in the motion of the needle bar, and with his brother, he formed the firm of Humphrey Brothers, which in 1876, was acquired by John W. Lufkin, who made some improvements upon the Humphrey device, and received a patent on May 3, 1880, marketing it as the Lufkin Machine.

Humphrey believed a better machine could be produced, and one that would attain greater speed and operate more easily and on February 27, 1883, and again in January, 1884, patents were granted him on the Rapid Buttonhole Machine, which produced a stitch that more closely resembled hand work and which could be operated at a much higher rate of speed.

J. J. Sullivan, of Haverhill, was given a patent on an important improvement of the feed mechanism for buttonhole machines on January 20, 1876, which was applied to the Lufkin and Singer machines, and the Sullivan Attachment Company was organized to manufacture the device.

THE REECE BUTTONHOLE MACHINE

In 1877, John Reece, while acting as agent for one of the buttonhole machines then on the market became aware of the imperfections of the devices and reached the conclusion that the only remedy was a radical change in both the stitch and the feeding action. For three years he experimented, and in 1880, produced a machine, using a regular lock stitch, in place of the loop stitch, and instead of revolving the work around the needle he caused the needle to travel around the buttonhole. He attached a cutter to his machine, and when the work was in position and clamped down, the hole was cut and the sewing began. It started at the rear of the buttonhole, the top of the machine moving forward automatically until the needle turned around the front of the buttonhole, and then moved backward again, finishing the other side of the buttonhole, and stopping automatically at the end.

The Reece Buttonhole Machine Company was organized, and in later years numerous minor improvements were added, which were protected by separate patents. Today, the company employs 500 operatives in its Boston factory.

NOTABLE CONTRIBUTIONS OF FRANK W. MERRICK

Frank W. Merrick, president of the American Stay Company ranks as one of the most prolific inventors of this generation. While with the National Machine Company he developed a machine for making McKay welts, and another for making welts and turns on a straight needle machine. The initial success of the stitch down shoe was due to his efforts while in the employ of that concern. At that period he developed the Merrick sewing machine—a radical departure in wax thread machines, in that the movements were entirely new, while the device developed three times the speed of the ordinary wax thread apparatus. The invention was marketed by the Merrick Sewing Machine Company, and at about the same time Mr. Merrick developed a power eyeletting machine, which was manufactured by the Power Eyeletting Machine Company, later absorbed by the United Shoe Machinery Corporation, the device becoming the basis of the corporation's eyeletting machine business.

In 1892 Mr. Merrick began the development of the Puritan machine, which he completed the following year and which was manufactured and marketed by the Puritan Manufacturing Company. It proved a great success, displacing practically all machines of this type then on the market, and revolutionizing the method of fitting the type of shoe which depended on a wax thread sewing machine for its construction, inasmuch as its capacity was about three times that of the type then in use. It also opened up new avenues for wax thread work and in a few years upwards of 5,000 of the machines were sold.

In 1898 Mr. Merrick conceived the idea of making a welting for heel seams and for all seams on boots and shoes where a leather welt is used, and which would have a round finished edge. This invention gave rise to the Union Welting Company a successful concern, which later was merged with the American Stay Company.

Just previous to this invention Mr. Merrick had constructed a blind stitch sewing machine, an awl-feed McKay sewing machine, a curved needle stitching machine, a loop lock stitching machine, and a high speed chain stitch machine, capable of from 3,000 to 3,500 stitches per minute, which was used with a spiral grooved needle, doing away with the use of the cast-off, which had been common on all wax thread machines up to that time.

The next invention he turned out was a high speed rotary shuttle lock stitch machine, which doubled the products of harness manufacture, and hundreds of these were installed in place of the prevailing type.

In 1905 the Union Lock-Stitch Company was organized with capital of \$500,000 to manufacture and market the machines.

In 1911 Mr. Merrick designed a new welt shoe, which was the first really successful shoe produced since the Goodyear process—better than the old type of welt and capable of being produced at much less cost. In 1913, the Union Lock-Stitch Company began the manufacture of this type of shoe, and this meant the construction of a new line of machinery which Mr. Merrick ultimately developed, first providing a machine to mould and form the inner sole, which embodied entirely new principles and movements, as the new shoe was not channeled as on the Goodyear welts.

His next product was a lasting machine, which completed all opera-

tions without removing the shoe from the machine, the pulling over being done on it, and the fastening being accomplished without the use of tacks. For this purpose, two lasting tools were invented by him, one for side lasting, using soft wire which was trimmed out when the in-seam was trimmed, to the end that no wire would be left in the completed shoe, and the other for the purpose of tacking the heel seat, by driving a wire through the medium of compressed air. The principles involved in these two tools were radically different from anything ever used before in the method of handling wire.

Next, a curved needle stitcher and welter were developed, by him, the former having a capacity 25% greater than any of the machines then on the market. The shoes welted on this machine had a tighter and flatter in-seam than was being produced on any welt shoe. A special machine to trim the in-seam was invented and altogether Mr. Merrick was granted several patents on the shoe and on the process of manufacturing.

Believing that a shoe of this type, possessing a water-proof in-seam, should be provided with a water-proof filler, Mr. Merrick developed the latter, which, while flexible, was also impervious to water and no more expensive than any of the well-known fillers then on the market.

In addition to these inventions in the shoe machinery field, Mr. Merrick has designed and produced twelve or fifteen machines for cutting leather, scarfing and skiving it and for finishing the edges, as well as various machines for folding different types of materials. Many of these machines are today in use in the plant of the American Stay Company.

THE BIRTH OF THE UNITED SHOE MACHINERY CORPORATION

The introduction of Matzeliger's lasting machine but added to the anomalous situation that presented itself to the shoe manufacturers of the period, because it added another agency to the McKay and Goodyear systems. Each was manufacturing some machines that were similar in operation to those the others produced. Each had its own force of salesmen. The three agencies provided their own corps of machine repairers, and it was not uncommon to find the trio gathering at the same hour in a given plant with entirely separate, if not distinctly hostile, ideas and purposes, and out of this Babel of conflicting interests there could be no coördination of shoe production.

The hand of a genius was needed in the closing days of the nineteenth century to do away with confusion, duplication and waste of energy.

Few men in the history of world-industry have faced a more difficult task than that which confronted the late Sidney W. Winslow, but he adroitly approached the situation, firm in his conviction that the four decades of wandering in the wilderness of shoe-machinery invention must end with the dying nineteenth century and that with the dawn of the twentieth the divergent groups should march on in serried ranks to the heights of greater accomplishments.

Charles Goodyear had died; Gordon McKay was then approaching his eighties; Benjamin Franklin Sturtevant had passed from earthly scenes nearly a quarter of a century before; Elias Howe's contribution of the sewing machine had become an accepted commonplace, due to its long use, and he, too, was dead; J. B. Nichols who first adapted the Howe machine to the stitching of leather was no more; Jans Matzeliger, Lyman R. Blake and Robert H. Mathies had gone to their rewards, and thus the group of

great inventors and forecasters of new methods of manufacture had departed. The situation required a man possessing the patience to discover machine experts, the art of winning capital, the executive ability to coördinate the rival shoe machinery producers, and the vision to market the machines manufactured.

Mr. Winslow was the sole remaining outstanding member of the group of shoe-machinery experts, and in February, 1899, he induced representatives of the three principal warring elements,—the Goodyear Shoe Machinery Company, the Consolidated & McKay Lasting Machine Company, and the McKay Shoe Machinery Company—to place their feet under the same table, and there emerged from that momentous conference one of the giant industrial powers of Massachusetts, destined to become, during the first quarter of the twentieth century, the great leader of the boot and shoe world and now known as the United Shoe Machinery Corporation, with authorized capital of \$75,000,000, with himself as its first president, and with all the coöperating interests represented upon the board of directors.

The principal machines which each company made did not interfere with the primary products of any other, but they were dependent links in a manufacturing chain.

Almost over night the amalgamation of the three companies into a single organization wrought greater economy in administration and freed the manufacturer from the annoyance and expense of dealing with different concerns.

The United Shoe Machinery Corporation has full control of the equipment covering McKay sewing, metallic fastening, pegging, welt and turn sewing, lasting and heeling machines, as well as most of the minor devices that were considered of practical value. The Gem Flexible Insole Company, the Boston Shoe Tool Company, the Power Eyeletting Machine Company, the Boston Fast Color Eyeletting Machine Company, Messrs. Sneller, Osman & Chessman, of Ansonia, Conn., J. C. Rhodes & Co., and others ultimately came into the combination, some being continued as separate units, with the United Shoe in control of the stock.

THE MAMMOTH FACTORY AT BEVERLY

The factory of this great industry erected at Beverly, in 1905, is now the largest and most completely equipped of its kind in any part of the globe, and if one of the numerous watchmen employed were to be forced to make the complete round of all the routes of the entire force of watchmen he would walk six miles through the seventeen buildings, with their aggregate floor space in excess of twenty-five acres, before he returned to the starting point.

The seventeen units are connected by wings, the two main factory buildings or machine shops being each sixty feet wide, four stories each in height, and 1,120 feet in length, or more than a fifth of a mile long. Here the parts that enter into the machinery vary from springs that are so infinitesimal that it requires 425 of them to weigh an ounce to machine frames weighing, in some instances, as much as three-quarters of a ton each.

Gathering about him the greatest mechanical experts available, Sidney W. Winslow established the experimental division which began the herculean task of selecting and improving the then existing inventions,

and into which as much as \$450,000 a year was poured for research work, and which has grown until it occupies forty-three designing rooms. No less than 125,000 distinct kinds of machine parts are kept in stock, all of which enter into the assembling of nearly 500 kinds of shoemaking machines that constitute the corporation's products.

It seems almost unbelievable that up to the middle of the last century shoes were made without the aid of machinery. To the primitive and crude implements which were used back in the days of the pyramids, the shoemakers of this country and of other nations had made only such simple additions as the lapstone, the hammer, the pinchers, and different types of sticks and bones for finishing their work until about seventy-five years ago.

With the present day familiarity with modern machinery it is difficult to realize that all this wonderful development has taken place within the lifetime of many persons who are still living, and the most important part since the incorporation of the United Shoe Machinery Corporation.

Today, it is rising to a new peak in its volume of business; to larger fields of usefulness in making footwear, and to an enhanced and commanding position in the affairs of the manufacturing world. It now owns and operates nine plants in the United States and abroad for the production of shoe machinery, the total number of individual factories approximating fifty-two, including units where are also produced findings and accessories, such as eyelets, nails, tacks, lasts, brushes, dies, cutters, paper cartons and wooden packing cases.

When the Supreme Court of the United States ordered the heart cut from the company's shoe machinery leases, certain of whose restrictive clauses were declared to be in violation of the Clayton Act, the concern promptly proved its claim to supremacy in its chosen field without these factors.

THE GENESIS OF ITS LEADERSHIP

Its leadership has come about naturally through the exceptional service rendered by the corporation to its customers, first, in the leasing of the machinery made by it on a royalty basis, and second, by the system of maintenance whereby day and night, in all sections of the country, the users of the machinery have at their call expert repair crews furnished by the company, through branch offices.

The money tribute paid for this service is ridiculously small in proportion to the total cost of a pair of shoes. The United States Census of Manufacturers for 1923 valued at \$950,000,000 the country's total output of 351,000,000 pairs of boots and shoes of all kinds, except rubber shoes, and in the same year the earnings of the United Shoe Machinery Company, before taxes and contingencies, were approximately \$6,500,000, or less than three-quarters of one per cent of the total shoe output value. The average per pair was under two cents. Even these figures do not give a correct idea of the comparative insignificance of the royalty and rental payments, as the company's published reports also include all earnings from its merchandising and foreign business.

The corporation operates foreign companies at Buenos Aires, Argentine Republic, South America; at Melbourne and Sydney, Australia, and Wellington, New Zealand; at Bruxelles-Midi, Belgium; at Rio de Janeiro, Brazil, South America; at Montreal, Canada; at Santiago, Chili, South

America; at Havana, Cuba; at Copenhagen, Denmark; at Leicester, England; at Tammerfors, Finland; at Paris, France; at Frankfurt a Main, Germany, branch offices being maintained in Vienna, Austria, in Aussig, Czecho-Slovakia, and in Holland; at Milan, Italy; at Mexico City, Mexico; at Oslo, Norway; at Port Elizabeth, South Africa; at Barcelona, Spain; at Orebro, Sweden; at Zurich, Switzerland; and at Montevideo, Uruguay.

This great corporation is engaged in producing machinery that not only girdles the globe, but that manufactures shoes made from skins, fabrics, metals and chemicals thus rendering its geographical domain as wide as the world itself, since the animal, vegetable and mineral kingdoms are called upon to contribute to the commodities fashioned by its uncanny mechanisms.

Furthermore, the approximately 500 types of machines it manufactures are keyed to produce men's, women's, misses', youths' and children's shoes for style and for service; light and heavy, high and low, laced and buttoned, sewn and nailed, from all types, kinds and grains of leather or of fabrics, many of which require two hundred or more distinct operations in fabricating a single pair, and some of which are simple, some, of necessity, most intricate, with adjustments and fittings as fine as in a watch.

Probably in no other industry in the world are so many necessary operations performed as in the manufacture of shoes by machine, or are so many distinct types of apparatus employed upon the same unit of production.

The work in a modern shoe factory, starting with the cutting and assembling of parts, proceeds continuously from one machine to another until at the end of the route the finished product emerges ready for shipment, thus emphasizing the importance of coördination of machines to the end that each in a given series will so efficiently perform its function as to pass it on to the next succeeding piece of apparatus and effect that continuity of machines that will carry on the work without interruption.

With no rival on the industrial horizon, and in the strength of its trade position, the United Shoe Machinery Corporation stands almost alone among the world's manufacturing giants. It is unique in that while there are many patented mechanical specialties of limited use that possess a practical monopoly of their respective fields, the domination of the world market by this corporation of a group of mechanical products that any person is free to imitate, if not duplicate, inasmuch as many of the basic patents have long since expired, makes it peculiar to itself in the field of manufacturing.

In 1929 work was begun on a magnificent office building, in Boston, to be occupied by the corporation upon completion in 1930. Of the total authorized capital issue of \$75,000,000 the corporation has outstanding \$59,131,066. Its officers are: chairman of the board, Edwin P. Brown; president, Sidney W. Winslow, Jr.; vice presidents, John H. Connor, Moses B. Kaven, Harold D. Donham, William R. Sampson, Charles G. Bancroft and Nelson W. Howard; secretary, Harold G. Donham; treasurer, Halsey E. Abbey.

CHAPTER XLVIII

BROCKTON

THE WORLD'S GREATEST CENTER OF SHOE PRODUCTION

The chief mourners who are constantly preparing to attend the obsequies of industrial Massachusetts and whose powers of analysis are as futile as their ill-advised conclusions would, no doubt, point to Brockton and other South-Shore shoe-centers as conspicuous examples of manufacturing gone wrong, because, in the second quarter of the twentieth century these localities are famed throughout the world as the seats of shoe-manufacturing corporations whose magnitude of operations is met nowhere else in the world.

Without question these critics would say that because, in 1790, North Bridgewater, often referred to by historians of the early days as the North Parish, and later merged into the town and city of Brockton, was the habitat of a fulling mill, numerous tanneries, saw and grist mills, and a famous iron forge which flourished during the first decade of the nineteenth century, when it took rank as being one of the first industries of the older community, it should have continued to maintain these types of manufacture and not have developed into the greatest shoe-producing city of the East.

But fate decreed otherwise, and early in the last century the forge gave way to shoe last and wood-turning concerns which occupied the building where formerly the fires blazed up in their primitive effort to produce iron out of the inferior bog ore harvested from the depths of Plymouth County's lakes and ponds.

A hundred years ago Brockton (then North Bridgewater) boasted of a cotton mill, possessing 350 spindles, employing fifteen persons, using 16,000 pounds of cotton annually, and turning out 60,000 yards of goods, with an invested capital of \$8,666; a hat factory, making 2,000 hats yearly, of a value of \$6,000, and employing six persons; a fork and hoe factory, representing an investment of \$400, and employing two workers; three chair and cabinet-ware manufacturers, employing thirty-nine hands, and utilizing \$38,500 of capital, a woodenware manufacturer, who turned out products annually valued at \$300; two shoe tool manufacturers, whose annual production was valued at \$1,900, and who employed twenty-two workers and carried on business with aggregate capital of \$5,000.

By 1845 these industries had been augmented by manufacturers of musical instruments, brushes, saddles, harness, trunks, railroad cars, coaches, chaises, and other vehicles, tinware, stoves, snuff, cigar, tobacco, pumps, mechanics' tools and packing boxes, and ten years later soap and tallow candles had been added to the variety of products.

How many of them do we find today listed among Brockton's 259 manufacturing concerns?

Not a single one, unless we include the various 1928 producers of mach-

inery in Brockton, in the category of "mechanics' tools," and the manufacture of wooden packing boxes.

Aside from paper boxes, which in reality are essential to the marketing of shoes; printing, which is quite an important element in the dissemination of footwear; carbonated beverages; newspapers; cigars; gas and electricity; rugs; interior finish; raincoats; confectionery; art calendars; furniture; bread and bakery products; fire escapes; cabinet work; toys; iron castings and laundering, every other industrial corporation or partnership in Brockton is engaged in shoe production or in shoe cut stock and findings, including lasts and related products.

And yet we suppose these scoffers would say that the great Shoe City of Plymouth County had retrograded industrially because there was not being carried on in 1928 in that locality the manufacture of musical instruments, brushes, saddles, harness, trunks, railroad cars, coaches, chaises, and other vehicles, stoves, snuff, pump, etc.

MICAH FAXON—THE PIONEER SHOEMAKER OF BROCKTON

To Micah Faxon probably more than any other man, may be traced the rise of the shoemaker's art in Brockton. He came to North Bridgewater from Randolph, in 1811, and shortly afterward completed 100 pairs of fine calf spring-heel shoes, which he carried over the road to Boston on horseback, where he sold them to Messrs. Monroe & Nash, at Long Wharf. Later, he employed vehicles to transport his products to market, and received his meagre supplies of raw materials via wagons which came out from Boston and delivered other commodities to the citizens of the community.

Silas Packard and Col. Edward Southworth were contemporaries of Faxon and began shoe production soon after he introduced the art locally.

Not until 1865 was shoe manufacturing in Brockton carried on with the assistance of steam power, all of the operations prior to that time being executed by hand. Charles R. Ford, Daniel S. Howard, F. O. and F. A. Thayer, Samuel Herrod and George Stevens were among the first local shoe manufacturers who installed steam-power plants in their respective factories.

Thus it was that from a few small, obscure rooms in the houses of the early shoemakers of Brockton there grew the gigantic, up-to-the-minute plants which distinguish the shoe production of the city today.

Approximately ninety years ago (1837) there were produced in what is now Brockton 79,000 pairs of boots and 22,300 pairs of shoes, the aggregate value of which was \$184,200, hardly representative of the total value of a year's product of Brockton's smallest shoe manufacturing concern of today. There were employed that year in all her boot and shoe factories 750 males and 375 females. It is quite significant of the trend of the times to note the gradual disappearance of boots and the marked increase in the use of shoes that occurred between 1837 and 1855. The number of boots produced in Brockton fell in that period from 79,000 pairs in 1837 to 66,956 pairs, in 1845, while the number of pairs of shoes increased in the same period from 22,300 to 674,760 pairs. The value of these products was \$72,847, and there were employed in 1855 in the boot and shoe industries of Brockton 1,146 persons.

By 1865, the distribution of local products had so increased that 103,066 pairs of boots were made and sold by Brockton Manufacturers, an

increase of 36,000 over ten years before, but 1,009,700 pairs of shoes were locally produced, an increase of 315,000 over 1855.

The aggregate value of these boots and shoes was \$1,466,900, or a little more than twice the value of the products of ten years previous. The number of employees had increased in the same period to 1,059 males and 508 females. In 1875 the seventy-three boot and shoe establishments in Brockton employed 3,977 workers, of which 3,090 were men and 887 women; they paid wages aggregating \$1,261,996; and stock and materials valued at \$4,802,348, and produced boots and shoes valued at \$7,411,919.

BROCKTON TURNS ITS BACK ON CHEAP SHOES

In the early days Brockton was known far and wide as the center of production of cheap American-made shoes.

But the turn came in 1875 and now for upwards of half a century Brockton-made shoes have been synonymous with the best of styling, quality and tannage and her internationally-known brands are demanded by customers in all lands under the sun who desire the best in footwear.

While Lynn and Haverhill manufacturers confine their activities almost entirely to women's shoes, and admit their inability to compete with Brockton in the production of men's shoes, there have been months in recent years when the plants in the latter city have shipped more women's shoes and men's, and today one of Brockton's big plants turns out as much footwear for women as for men. Between ten per cent and fifteen per cent of the total production in Brockton is women's wear.

It is a far cry from Brockton's seventy-three boot and shoe plants of 1875 to the upwards of 105 factories now engaged in the manufacture of these commodities and of related products, and from the \$7,411,919 value of fifty years ago to the \$60,442,873 value of 1927.

GEORGE ELDON KEITH COMES UPON THE SCENE

On February 8, 1850, there was born in that part of Brockton known as Campello, George Eldon Keith, whose influence upon the industrial life of the community was to leave its impress for many generations. His industry, perseverance and thrift were shining examples of what may be accomplished if one but has the will to act. While pursuing his studies in the schools of Brockton he found it possible to use his mornings and nights working at a shoe bench, and in July, 1874, at the age of 24, with \$1,000 accumulated by dint of hard work, he entered partnership with William S. Green, under the firm name of Green & Keith. During the first six months the sales of the concern amounted to \$7,000, and at that time Mr. Keith did all the cutting of leather. The partnership was dissolved in 1880, when the junior member formed the Geo. E. Keith Company, the great corporation which today bears his name, and with which his descendants are prominently identified. Over 6,000 retail dealers throughout the world handle the company's shoes.

It is a far cry from 1758, seventeen years before the Revolution, when Levi Keith, great-great grandfather of Harold C. Keith, the present president of the Geo. E. Keith Company, was making shoes and tanning leather by hand, to the plant of today, with its fifty-nine buildings, the combined floor area of which is 1,152,900 square feet, while 5,100 employees daily produce 10,000 pairs of men's and 10,000 pairs of women's shoes, nearly 200 of these workers having worked continuously for the concern for

more than a quarter of a century, while 300 dealers on the list of the company's customers have handled the products for twenty-five years or longer.

This family of shoemakers traces its ancestry to the Rev. James Keith, first minister of Bridgewater, who came from Scotland in 1662.

Levi, the first of the family to make shoes, was the great-grandson of Rev. James Keith, through his son, Timothy. Levi's son, Benjamin although principally a farmer, also operated a tannery and manufactured shoes. Ziba, son of Benjamin, early learned the art of shoemaking which he followed during the winter months. Ziba's son, Franklin, received his training in shoemaking in the "Old Red Shop," as the ell of the house was known.

Franklin Keith depended almost wholly upon the making of shoes for his livelihood and after he had built a home of his own worked at this occupation in a small section of his house.

It was in this little back room that Franklin's son, George Eldon Keith, founder of the Walk-Over industry, at the age of ten, began making shoes with his father. That part of his father's home was preserved by Mr. Keith and now stands amid the giant factory buildings, a striking contrast between the old and new methods of shoemaking.

During the life of Franklin Keith machinery became a factor in shoemaking and in 1856, in company with his brother, he began the making of shoes on a large scale, employing about thirty men and women, and in this factory Geo. E. Keith worked at the bench until twenty-one years of age.

THE GROWTH OF THE COMPANY

The original Keith plant, now known as Factory No. 1, was from time to time enlarged until it became one of the largest manufacturing plants in New England. In 1897 the No. 2 factory was erected and from that time on new units were added to the group until, in 1908, the plant consisted of Nos. 1, 2, 3, 6, 7 and the Box Mill, in Campello, and No. 4 in Middleboro.

The manufacturing of women's shoes was commenced in 1908 in the new No. 8 factory, located in East Weymouth. No. 9 factory in Boston was added in 1912 and No. 10 in Rochester, N. Y., in 1913.

In the meantime the executive office building, one of the finest in the shoe industry, had been erected in Campello, in 1911, and the St. Louis branch of Department 6 had been added in 1912.

In 1920 Warehouse A was erected, closely followed by the construction of the central heating plant.

In 1921 another addition to the plant was erected, No. 11 factory, one of the largest and best equipped in the world.

During the World War over 1,000,000 pairs of Walk-Over shoes were made in the No. 3 factory for the United States Army. This work necessitated an entire change in equipment and machinery of the factory and was prompted solely by patriotic motives of the Keith Company, when it became necessary to rush the manufacture of shoes in order to supply the troops rapidly being whipped into shape in the training camps. These shoes were made without profit to the company.

The Walk-Over Club, the play-ground not only of the company's employees, but truly a community center, was erected by Mr. Keith and his



WHERE GEORGE E. KEITH BEGAN MAKING
SHOES IN 1860, WHEN TEN YEARS OF
AGE

This part of his father's house was preserved
by Mr. Keith and now stands amid the giant
factory buildings, a striking contrast between
the old and new methods of shoemaking



PRESENT PLANT OF THE GEORGE E. KEITH COMPANY, (CAMPELLO),
BROCKTON

company in July, 1914, to commemorate his fortieth anniversary as a shoe manufacturer. The finely equipped club house stands in a 13-acre park laid out for all kinds of out-of-door activities.

The company also operates several restaurants for the convenience of employees. A practising physician who conducts a free health clinic two hours daily, a graduate registered nurse who is constantly in attendance, and a coöperative insurance plan for employees are some of the other features of the Keith industry.

The company has capital of \$8,539,000. Of the present day output about 60% is made up of women's shoes and the balance is men's footwear. The largest American exporter of shoes, the concern found its 1928 business running ahead of the previous year. In addition to marketing its goods in 104 countries of the world, there are eighty-four Walk-Over shoe stores operated by the company in the United States.

The present officers of the corporation are Harold C. Keith, president, Myron L. Keith, George H. Leach, and Charles E. Moore, vice presidents, E. W. Stedman, secretary, and Walter E. Johnson, treasurer.

President Keith is now serving as president of the National Boot & Shoe Manufacturers Association, whose headquarters are in New York City, and vice president Moore is the president of the Brockton and South Shore Shoe Manufacturers Association.

THE WORLD'S BEST KNOWN PORTRAIT

At the age of seven years William L. Douglas was bound out to his uncle, a shoemaker, and put to work, pegging shoes, a hand operation which required that he stand on a box to reach the bench where certain parts of the work was done. When he reached the age of eleven he was paid at the rate of five dollars a month for the next four years, but his desire to become a master craftsman led him to work for this wage for eight years. He next sought employment in shoe factories in South Braintree and Hopkinton, making men's heavy shoes, and for three years was a pupil of the master craftsman, Ancil Thayer.

The opening of the West, at the close of the Civil war, appealed to him as an opportunity to see some of the United States, and at the same time ply his trade. Settling in the town of Black Hawk he associated himself with Zephaniah Meyers, famous as the best bootmaker in the west, and soon his fame spread to Golden City, Colorado, where Alfred Studley, an old Bay State shoemaker was located. He sent for Douglas and offered him a partnership in his retail boot and shoe store, and, in 1866 the *Transcript*, a newspaper printed in Golden City, carried the advertisement of Studley & Douglas. Notwithstanding the success of the venture, Douglas preferred the manufacturing end of the business, and he returned to Massachusetts, and was superintendent of the Porter & Southworth factory, at North Bridgewater, from 1870 to 1875.

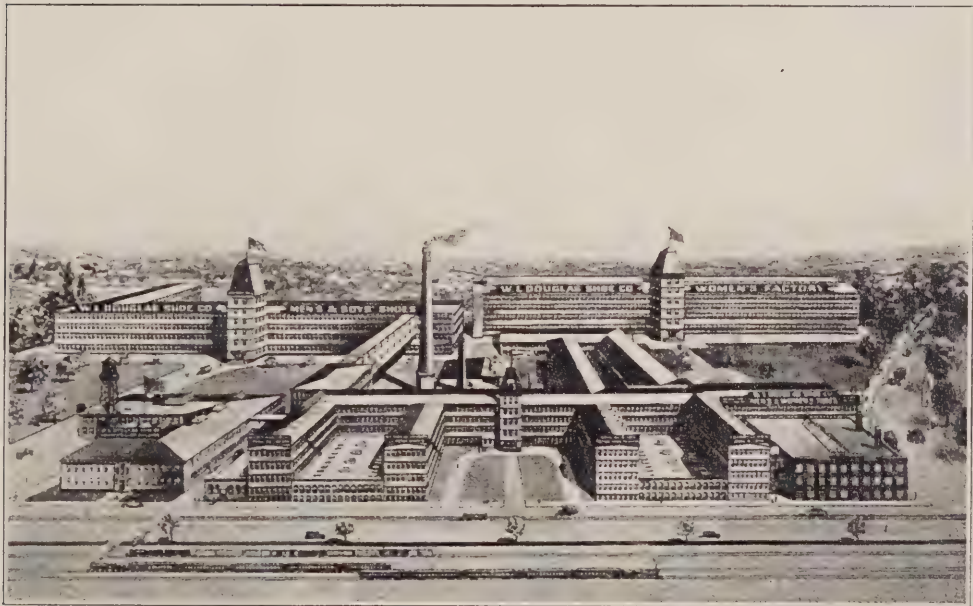
In the centennial year of 1876, at the age of thirty-one years, he founded the business which today bears his name, his capital consisting of \$875, which he borrowed. He began manufacturing in a room 30 by 60 feet, in the building previously occupied by Porter & Southworth, employing five workers and putting out forty pairs of shoes a day.

Such was the foundation of the great industry, which today employs nearly three thousand operatives, who turn out 20,000 pairs of shoes a day.

At the outset, he was not only his own buyer, cutter and salesman,



WHERE THE LATE GOVERNOR WILLIAM L.
DOUGLAS MADE HIS FIRST SHOES



PRESENT PLANT OF THE W. L. DOUGLAS SHOE COMPANY, (Montello)
BROCKTON

but his own expressman as well, old Brockton residents taking delight in recounting that they often saw him coming from Boston, with rolls of leather under his arm and of his going back to the city, with finished shoes to sell.

In 1879 he removed to larger quarters and in 1881 erected a large three story factory, where he manufactured 840 pairs of shoes per day. Soon he doubled the factory space by enlarging the plant and increased production to 1,800 pairs daily.

It was in 1884 that he put into action the plan he had long entertained, namely of making his shoes known in every civilized country of the globe, and to make his the best known portrait in the world. His initial advertisements featured his \$3 shoes, and later the announcements carried his portrait—his first trade mark—and he asked the public to look for his picture stamped on the soles of the shoes they bought.

WHAT ADVERTISING DID FOR W. L. DOUGLAS

For many years the W. L. Douglas Shoe Company spent upwards of \$250,000 a year for advertising, with the result that by 1892 the increasing business demanded a new factory, which was built at Montello, with a capacity of 3,600 pairs of shoes a day. That year the company was incorporated, with \$2,500,000 capital, later increased to \$10,000,000. Addition after addition followed until today it is one of the largest shoe factories, under one roof, in the world, affording 350,000 square feet of manufacturing space, and equipped to turn out from 6,000,000 to 7,000,000 pairs of shoes a year. Here the skins of 1,800,000 animals, over 1,000,000 yards of cloth, 4,000 tons of sole leather and fifteen thousand miles of flax thread are used annually.

If a year's output were to be placed heel to toe the shoes would reach from Boston to Omaha, Nebraska, and if piled one pair on another would extend in the air 256 miles. If packed in cases and shipped by rail in one train, they would require 572 freight cars, and make a train six and a half miles in length.

While a member of the Massachusetts Legislature Mr. Douglas was the author of the weekly payment bill, and while serving in the State Senate he introduced the bill which led to the creation of the State Board of Arbitration and Conciliation. His public career was crowned by his election to the Governorship of Massachusetts.

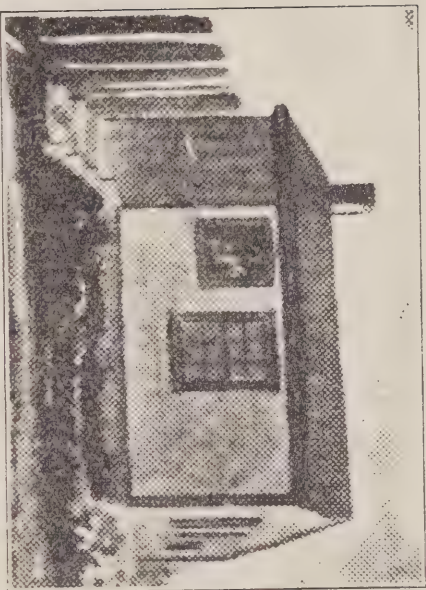
Hundreds of letters are received at Brockton bearing nothing on the front of the envelopes by way of addresses save the picture of W. L. Douglas, taken from the advertisements and pasted on the receptacles—convincing evidence that the portrait of this Massachusetts man is the best known trade mark in the world.

With its chain of 110 retail stores and 6,000 other dealers handling Douglas shoes, the company's distribution is universal.

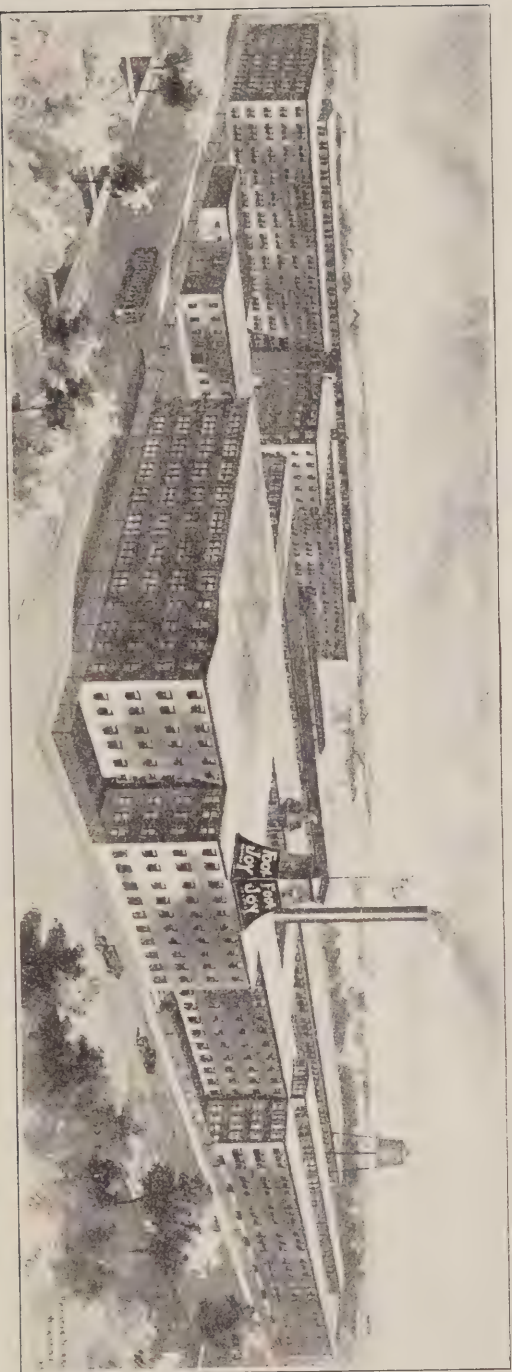
The corporation has capital of \$10,000,000. Herbert L. Tinkham is president, C. D. Nevins, vice president, and B. J. Torrey, secretary.

THE RISE OF THE FIELD & FLINT COMPANY

In 1857, Fred Packard began the manufacture of shoes by hand, in a little one story cabin, which still stands today on the Field estate, in Brockton. From that humble beginning there developed a nation-wide demand for "Korrect Shape" shoes, which necessitated increasingly larger



THE LITTLE CABIN WHERE FRED PACK-
ARD, FOUNDER OF THE PRESENT-DAY
FIELD & FLINT COMPANY, BEGAN THE
MANUFACTURE OF SHOES, BY HAND IN
1857



FIELD & FLINT COMPANY FACTORIES, BROCKTON

quarters, in 1879, and in the nineties a big plant was erected. In 1900, the Burt & Packard Company, for such it had become in the interim, moved to its present location.

The Field & Flint Company the corporate successor of the former concern, was the first shoe enterprise in the country to employ individual electric motors on each machine, thus doing away with overhead shafting and pulleys.

Interested in past events only to the extent that they explain present achievement, the "Foot Joy" product of today is not only a name, but an institution, representing as it does three generations of experience in the shoe industry.

During the World war, by means of day and night forces, the Field & Flint Company manufactured 20,000 pairs of shoes each day for the fighting armies, and today 700 operatives are employed, the concern being capitalized at \$1,000,000.

Fred F. Field is president, Fred F. Field, Jr., vice president, and Perley G. Flint, treasurer, of this corporation.

FROM A CARPET-BAG TO A \$300,000 SHOE CONCERN

The present day Stacy-Adams Company is traced to an old-fashioned carpet-bag, in which samples of women's shoes were toted as far west as Cleveland, by W. H. Stacy, and to Harry Adams, who, in 1861, started in blacking the edges of boots for Burt & Terhune, and who, five years later, went on the road with the first men's shoe ever sold under the name of Burt.

In 1870, these two young men formed the firm of Stacy & Adams, which, two years later became John W. Burt & Co. Subsequently, J. W. Burt retired, and with S. Gardner Jones, the house of Stacy, Adams & Jones was formed, in 1875, and a modest factory built at Brockton, in which, the following year, the firm manufactured shoes, which sold for \$210,000. Three years later, Jones withdrew, and was succeeded by O. B. Quimby, and the firm name became Stacy, Adams & Co. Subsequently, the Stacy-Adams Co., was incorporated. Today it is capitalized for \$300,000 and employs 300 operatives, in the manufacture of men's fine shoes.

C. P. Waide is president, W. A. French, vice president, John McElaney, treasurer and secretary, and A. F. Luce, assistant treasurer.

THE TOLMAN PRINT, INC., A PROGRESSIVE CONCERN

In 1875 the late Fred Sawin Tolman established a printing business in Brockton, and specializing in the shoe trade, was successful from the outset, but the founder little realized that in little more than half a century the concern bearing his name would take rank as not only being unique in its field, but as one of the outstanding units of its kind in the United States, nor did he picture in his mind's eye the coming of the day when the modest little business created by him would become linked up through the avenues of consolidation and merger with America's oldest and famous printing house—The University Press, of Cambridge, which dates back to 1639, when Stephen Daye came from the mother country, and installed in the city of culture on the Charles the first printing press brought to the colonies. Later acquired by President Dunster, the first head of Harvard University, the corporate successor of the Daye concern

has continuously exemplified the art of printing for well-nigh three centuries, having long since become an institution, rather than a mere business concern, and has contributed the most conspicuous chapters to the history of printing on this continent. The University Press was developed largely along book lines and its associations with the early and later literary life of America have been notable, listing among its customers many of the more prominent business houses of the country.

The Tolman Print, Inc., long since branched out into the broader field of commercial printing and national advertising, manning its staff with specialists and handling the accounts of some of the country's largest national advertisers.

When, early in 1929, the consolidation of these two units was effected under the name of Tolman Print, Inc., it brought together the intelligence, skill and material equipment of two representative printing units, and constituted a merger which not only gave promise of economy in production, but assured the clients of both units of up-to-date service.

The two plants which are maintained at Brockton and Cambridge employ 350 or more operatives. The Tolman Print, Inc., maintains a Boston office at 80 Federal Street.

F. Harold Tolman, son of the founder, is president and treasurer, H. L. Brigham, secretary, and George M. Rand, vice president. The concern now operates as Tolman Print, Inc.-University Press, and has capital of \$750,000 preferred and 30,000 shares of no par common stock.

THOMPSON BROTHERS SHOE COMPANY

In 1880, two brothers, John F., and George H. Thompson began the manufacture of the Thompson shoe in a small, one and a half story wooden building, erected on the land where now stands the Brockton plant. Five years later, they sought larger quarters, and the first building of the present factory was erected. When John F., died in 1903, his surviving brother became the sole owner, and when George H. Thompson died in 1911, the heirs assumed control until the company was incorporated in 1916, under the name of Thompson Brothers Inc.

Because of the continued growth of a yearly business of \$1,000,000 in 1915 to approximately \$6,000,000 in 1919, it was found advisable in the latter year to reorganize and to allow the foremen, department heads, and salesmen by reason of their coöperation and faithful service, to become stockholders in the company, and the present day Thompson Brothers Shoe Company was created. In the intervening years the concern has grown to be one of the largest units in the city, employing 600 operatives and marketing its products throughout the United States. H. W. Fitz is president, Joseph E. Small, secretary, and H. M. Fillebrown, treasurer.

In 1908 the Lincoln Webbing Company was formed to manufacture tire tapes, shoe webs and dress and skirt beltings, and employs twenty-five operatives. The owners are Arthur W., Arthur M., and Edith L. Smith.

THE M. A. PACKARD COMPANY

In 1876, Moses A. Packard and Asa P. Howard began the manufacture of shoes in a small shop, in North Bridgewater, now a part of Brockton. Eight years later, Capt. R. B. Grover succeeded Mr. Howard, as a partner,

and, in 1889, he retired and Oliver M. Fisher and John S. Kent became members of the firm.

In 1898, the M. A. Packard Company was incorporated, and when, in 1913, Mr. Packard died, Mr. Fisher became president, serving until his death, in 1926.

The present officers are Hon. John S. Kent, president; Alfred T. Kent, vice president; John S. Kent, Jr., treasurer; and Dana B. Paul, assistant treasurer.

The Packard shoe is marketed throughout the United States and in many foreign countries.

The corporation has capital of \$700,000 and employs 350 operatives. The Boston headquarters are at 500 Statler Building.

GEO. BAKER & SONS, INC.

Geo. Baker & Sons, Inc., was established in January, 1911, at Whitman, by George B., Edward C., and Herbert B. Baker. In June, 1911, the tack business of Willard-Osborne Company, at Lakeville was purchased, and the following March the concern moved all its machinery to Brockton, where production increased so rapidly that night and day shifts were continually operated, and in order to secure additional manufacturing space the assets of the G. R. Finney Company were purchased in 1917, and these two plants continued to operate twenty-two hours a day until a modern factory was built, in 1922, with a railroad siding on the main line of the N. Y., N. H., & H., R. R. Co., in the Montello district of Brockton.

While located in the very heart of shoe production, no shoe tacks or nails are made by the concern for that trade, the entire production going into the automobile, furniture, hardware, trunk, basket and shoe repair industries. The capacity of the concern is the second largest among twenty-five plants producing these lines.

It is interesting to note that while this factory is located in Massachusetts it is purchasing 90 per cent of its raw material in Ohio and Pennsylvania and on the bulk of the output sold in the middle west it successfully competes with tack factories of that district.

The present officers consist of the three Bakers who established the business, together with Doris I. Baker, and the corporation has capital of \$225,000.

In 1911, Fred A. Putnam purchased the marking machine interests of the Sewing Machine Supplies Company and formed the Markem Machine Company, which manufactures and markets embossing and marking machines and the supplies used in connection with these devices. The concern operates factories in Brockton and Keene, N. H., and employs seventy-five operatives.

E. S. Morton & Co., owned by H. O. Davis, ranks as the oldest manufacturer of last thimbles and heel plates in the country. For over forty years this concern has been producing last makers' supplies of the highest quality, and shipping them to all parts of the world.

In 1925, the firm of Herbert, Stretch & Kendrick was established, and operates forty-five narrow looms in the manufacture of narrow elastic and non-elastic braids, employing seventy-five operatives.

Community Bakeries, Inc., was formed April 23, 1926, being a merger



PLANT OF M. A. PACKARD COMPANY, BROCKTON

of A. B. Hastings & Sons, Inc., of Brockton, and Durland & Candage of Brighton.

In the first two years following the consolidation, the sales of the Brockton plant increased 50 per cent.

The Brockton Narrow Fabric Company was incorporated in 1927, with capital of \$25,000, and produces elastic and non-elastic narrow fabrics. Arthur E. Carter is president, and F. E. Ahearn, treasurer.

In addition to the concerns, whose history has been treated previously, any list of the progressive industrial enterprises in Brockton must necessarily include the Acme Heel Company, with a capital of \$100,000, employing 100 in the production of men's and women's heels, Frank E. Shaw being president and Fred B. Leonard, treasurer; the Alger Paper Box Company, capitalized at \$100,000, and employing sixty in the manufacture of paper boxes, the Brockton unit being a branch of the main plant at Middleboro; the Barbour Welting Company, located at Montello, with a Boston office at 12 High Street, and manufacturing welting, which, for more than forty years, has entered into the construction of fine shoes, in every community where footwear is made by the Good-year Welt process; Barney, Capen & Denham Company, capitalized at \$50,000, employing 100 in the manufacture of shoes, W. H. Denham being president, H. T. Capen secretary, and G. W. Barney, treasurer; M. H. Bates Company, with capital of \$120,000, and manufacturing shoe trimmings, H. F. Bates being president and Minot H. Bates treasurer; the E. L. Bonney Box Company, capitalized at \$35,000, with thirty employees engaged in the production of wooden packing boxes, Mrs. K. B. Bonney being president, and J. A. Holmes, treasurer; the Brockton Coöperative Boot & Shoe Company, Inc., capitalized at \$25,500, employing 160 hands in the production of men's shoes, and with a Boston office at 11 South Street, J. H. Warne being president and Lars Peterson, treasurer; the Brockton Heel Company, with capital of \$1,000,000, employing 150 in the production of heels, J. E. Johnson being president and F. M. Burke, treasurer; the Brockton Last Company, with capital of \$100,000, and a force of from seventy-five to ninety engaged in manufacturing boot and shoe lasts and sole patterns, and maintaining a Boston office, at 11 East Street, Fred Drew being president and treasurer, and John B. Drew, clerk; the Brockton Peerless Rug Company, engaged in the production of rugs; the Brockton Shoe Manufacturing Company, with capital of \$288,000, employing 650 operatives in its Campello and Holbrook plants, in the production of shoes; the Brockton Stay Company, employing fifty, and capitalized at \$50,000, producing boot, shoe and auto leather trimmings, C. A. Helm being president and C. R. Carleton, secretary and treasurer; the Brockton Tool Company, with capital of \$100,000, owned by Levi Holmes, employing sixty hands in the manufacture of moulds for rubber heels and shoes; the Brockton Welting Company, engaged in the manufacture of welting; the Burkley Shoe Company, Inc., with capital of \$12,000, employing thirty hands in the manufacture of patent ventilated infants' shoes and moccasins, L. A. Burke being president and treasurer, B. M. Burke vice president, and W. D. Burke, secretary; the Campello Nail-less Heel Company, producing a new type of heel, employing fifty hands, Oscar Benson being president, and Charles Ryberg, treasurer; the Caroline-Becker Company, employing fifty-five, in the manufacture of cut soles and lifts; the Churchill & Alden Co., founded in 1877, and

capitalized for \$620,000, employing 250 operatives, in the production of shoes, Frank S. Farnum being president and treasurer, Mrs. H. Emerson vice president, and Joseph E. Coulter, secretary; M. B. Claff & Sons, Inc., employing forty in the manufacture of paper boxes; Condon Bros. Company, owned by John Condon, employing 150 in the production of shoes; Conrad Shoe Company, employing 425, at its Campello factory, in the manufacture of shoes, D. F. Quigley being president, and H. G. Tucker, treasurer; Corcoran, Gleason Shoe Company, with capital of \$50,000, and employing seventy-five in shoe production, James T. Corcoran being the owner and William M. Gleason the manager; the Joseph F. Corcoran Shoe Company, with capital of \$200,000, employing 250 operatives, in the manufacture of men's shoes, Joseph F. Corcoran being president and treasurer; the Craig, Reed Company, of Campello, capitalized at \$30,000, employing 125, and engaged in the manufacture of shoes, with a Boston office, at 10 High Street, A. T. Reed being president, and A. W. Craig, treasurer; the Diamond Shoe Company, with capital of \$2,000,000, employing 1,300 hands in the production of welt shoes; the Doyle Shoe Company, capitalized at \$90,000, employing 325 in the production of men's welt shoes, and maintaining a Boston office at 215 Essex Street, A. F. Doyle being president, and W. E. Doyle, treasurer and general manager; the Donnelly Machine Co., Inc., with a capital of \$100,000, employing fifty, and producing machinery and electrical appliances; the Dunbar Pattern Company, with capital of \$150,000, employing fifty, in the production of shoe patterns; the Charles A. Eaton Company, capitalized at \$400,000, employing 400, in the manufacture of shoes, C. C. Eaton being president, and A. L. McDonald, treasurer; the Elliott Shoe Company, with capital of \$50,000, employing 100, in the manufacture of shoes; V. and F. W. Filoon Company, capitalized at \$600,000, employing 300 in producing cut stock, Fred W. Filoon being president and treasurer; the A. J. Fish Printing Company, engaged in the production of high-grade printing; A. Freedman & Sons, Inc., with capital of \$190,500, employing 275, in the manufacture of men's welt shoes; the E. J. Givren Shoe Company, employing fifty-five, and capitalized at \$100,000, producing shoes, the partners being R. G. Stall, C. H. Dean and D. J. Golden; the Gleasonite Products Company, capitalized at \$400,000 and employing 150, in the manufacture of heels, soles and taps; the Golden Sporting Shoe Company, owned by E. J. Givren, employing ninety, in the manufacture of men's footwear; the Harvard Rand Company, capitalized at \$25,000, employing thirty-five, in the manufacture of rands, H. F. Bryant being president, and F. E. Shaw, treasurer; the Hamilton-Wade Company, employing 250 in the production of weltings and bindings, of which Ashton Hamilton is president and treasurer; Hilliard & Merrill, Inc., capitalized at \$500,000, and employing in its Brockton and Lynn plants 100 workers, in making cut soles and sole leather, and maintaining a Boston office at 185 Essex Street; Howard & Foster, Inc., capitalized at \$750,000, employing from 200 to 450, in the production of men's and women's shoes, and with a Boston office at 183 Essex Street; Keith & Floyd Co., employing fifty in the manufacture of sole leather box toes and counters; Kierstead-Anderson Co., Inc., capitalized at \$15,000, employing twenty-five in the manufacture of shoe trimmings, Fred W. Anderson being president, and Ashton B. Kierstead, treasurer; the Killery-Moriarty Shoe Company, employing seventy-five, in the production of men's shoes; the E. M. Low

Company, capitalized at \$25,000, employing fifty in the manufacture of paper boxes, Emery M. Low being president and Herbert C. Low, treasurer; the Chas. E. Lynch Shoe Manufacturing Co., Inc., of Montello, with capital of \$80,000, employing eighty-five in the production of physical culture shoes for men, Charles E. Lynch being president, A. E. Lynch vice president, and C. E. Lynch, Jr., treasurer and secretary; the Logan Company, engaged in the manufacture of box toes; the Massachusetts Box Company, with capital of \$237,000, employing eighty, at its Brockton and Lawrence plants, in the manufacture of box shoos and wooden and fibre boxes; the Mawhinney Last Company, of Montello, with capital of \$50,000, employing eighty-five in the production of shoe lasts and trees, this concern tracing its beginning to Samuel Mawhinney, who, in the '70s was the leading manufacturer of lasts in the United States, his establishment, then located in Worcester, having been started about 1844; the O. A. Miller Treeing Machine Company, with capital of \$500,000, engaged in the manufacture of shoe trees and laces, the concern being a subsidiary of the United Shoe Machinery Corporation; the Montello Heel Company, of Montello, capitalized at \$64,000, employing 100, manufacturing soles and heels, D. W. Field being president, S. C. Kayes treasurer, and E. L. Goodspeed, clerk; the Old Colony Shoe Company, capitalized at \$75,000, employing 150, in the production of men's shoes, J. A. Collins being president and I. Tarlow, treasurer; the Packard Carton Company, of Campello, capitalized at \$100,000, employing 125, and engaged in the manufacture of paper boxes at Brockton and Rockland, Cedric L. Packard being president and Frank E. Packard, treasurer; the C. S. Pierce Company, with capital of \$300,000, employing 375, in the production of leather goods and shoe specialties, Harry H. Williams being president and B. L. Sabeau, treasurer; Bion F. Reynolds Company, with capital of \$100,000, manufacturing men's shoes, Bion F. Reynolds being president, and Herbert W. Harlow, treasurer; Schwarz, Ruggles, Inc., with capital of \$75,000, employing 115, and producing shoes; F. M. Shaw & Son, capitalized at \$100,000, employing 150 in the production of sole leather, soles, rands and heel stock; Snell-Atherton-Norcross Co., Inc., capitalized at \$35,000, employing twenty-five, in the manufacture of shoe tools, knives and gauges, Herbert B. Norcross being president and treasurer; the Stall & Dean Manufacturing Company, capitalized at \$100,000, employing 100 in the production of sporting goods, C. H. Dean being president and R. G. Stall, treasurer; Stone-Tarlow Co., Inc., with capital of \$204,000, manufacturing men's and women's welt shoes and employing 200, with Samuel Stone as president, Benjamin Stone as vice president, and Daniel S. Tarlow as treasurer; The E. E. Taylor Company, with capital of \$2,250,000, and employing 2,400 operatives in its Montello and New Bedford factories; the Thompson-Field Co., Inc., capitalized at \$75,000, and manufacturing shoe supplies, Harry L. Thompson being president and E. M. Thompson, treasurer; the Union Shoe Company, with capital of \$100,000, employing 100 in the manufacture of men's shoes, James Alfred being president, Peter Whycunas, vice president and assistant treasurer, and Robert Leavitt, treasurer; the Victory Shoe Company, capitalized at \$50,000, employing ninety in the production of shoes; F. B. Washburn & Co., with capital of \$250,000, employing 300 operatives, in the production of confectionery and bakery goods, Stewart B. McLeod being president, Warren C. McLeod vice president, and Norman W.

Thompson, treasurer; Woodard & Wright Last Company, of Campello, capitalized at \$275,000, employing 100, and engaged in the manufacture of shoe lasts and patterns, with Louis F. Wright as president, C. F. Woodard vice president, and A. L. Bowman, treasurer; the White Star Laundry Company, with a capital of \$150,000, employing ninety, and taking rank as the largest laundering unit in Southeastern Massachusetts, with M. L. C. McCrillis as president and treasurer; the Whitman & Keith Company, capitalized at \$80,000, and employing 175 operatives, in the production of men's, women's and boys' shoes, W. P. Whitman being president and treasurer, and Richard P. Whitman, secretary; the Wind Innersole and Counter Co., Inc., of Campello, capitalized at \$300,000, employing 200, and manufacturing counters and innersoles, Max E. Wind being president and treasurer, and A. W. Horowitz, vice president; and George Knight & Co., owned by George Knight, engaged in the production of tip perforating and embossing machines and dies.

For more than a quarter of a century Brockton has avoided a conflict between labor and employer. The average Brockton shoe operative is American-born, the only foreign strain being the Swedish citizens—a most desirable type. Roughly 70 per cent of the shoe operatives in the city own their homes, and thus have a very vital interest in maintaining prosperity in the city.

The Brockton shoe industry is revealed as a factor in the national mobilization of industrial plants of the War Department. Brockton is declared to be a key point in the gigantic scheme for enrolling, as a national defence measure, the multifarious industries which contribute to the success of modern warfare. Twenty-five companies in the shoe and allied trades were listed under that branch of the military establishment for which they can speedily turn out supplies in a national emergency. Because the entire nation will be blanketed by the plans, it will be possible for the factories listed to turn out possibly 50 per cent of their normal commercial orders the while they produce war equipment, so that a minimum of business stagnation would result.

In 1927 there was a total industrial capital investment in Brockton aggregating \$44,389,228, of which total \$31,359,351 represented the capitalization of 105 concerns engaged in the production of boots and shoes, other than rubber, boot and shoe cut stock and findings, and lasts and related products, thus stamping the city as pre-eminently a shoe manufacturing center.

The value of production in these three industries, in 1927, totaled \$54,122,934, as against \$53,537,934 in 1926. Brockton led all other municipalities in Massachusetts engaged in the manufacture of shoes in the latter year.

Of the total value of all products manufactured in Brockton in 1927—\$66,308,686, boots and shoes (\$38,027,028) constituted 57.3 per cent of the whole, and boot and shoe cut stock and findings (\$15,341,182) represented 23.1 per cent of the whole, these two types of industry alone constituting approximately 80.4 per cent of the entire value of all Brockton products made that year.

The average number of wage-earners employed in the 251 manufacturing establishments in Brockton in 1927 was 12,121, of whom 8,238, or nearly 68 per cent, were employed in the manufacture of boots and shoes, and 1,738, or 14.3 per cent, were employed in the manufacture of boot

and shoe cut stock and findings. The total amount of wages paid to all wage-earners employed in manufacturing in the city during the year was \$14,748,417, of which amount those employed in the manufacture of boots and shoes received \$9,989,049, or 67.7 per cent, and those employed in the manufacture of boot and shoe cut stock and findings received \$1,840,812, or 12.5 per cent.

Other important products manufactured in Brockton in 1927, principally for use in connection with the boot and shoe industry, were iron and steel nails; lasts and related products; blacking, stains and dressings; models and patterns; and mucilage, paste, and other adhesives. The following industries were also represented in the manufacturing field; printing and publishing; bread and bakery products; foundry and machine shops products; and cotton small wares.

CHAPTER XLIX

THE INDUSTRIAL PROWESS OF THE TOWNS OF PLYMOUTH COUNTY

PLYMOUTH COUNTY AND ITS ENVIRONS EARLY BEGAN IRON INDUSTRY

As early as 1628, eight years after the Plymouth settlement, special encouragement from the mother country enhanced the search of minerals and this quest was followed by the gradual creation of iron companies in Abington, Raynham, Middleboro and Bridgewater, the treatment of iron being commenced in the latter town in 1707.

In 1652 James and Henry Leonard established the famous forge at Raynham, and a few years later George Leonard started his extensive iron works at Norton. Then followed similar developments at Rowley, Topsfield and Boxford, in Essex County, and early in the first decade of the eighteenth century furnaces were erected in Pembroke, Duxbury, Kingston, Abington and Hanover in Plymouth County. It was at the Duxbury forge that hollow-ware, such as pots and kettles, were first turned out on American soil, which the artificer, Joseph Mallinson, claimed had saved the Province annually 20,000 pounds in importation, and the General Court, in acknowledgment of his assertion, allotted him 200 acres of unimproved land. At one of the small furnaces in Kingston some of the initial experiments in smelting with anthracite coal were carried on early in the eighteenth century. At the Abington forge cannon and shot were cast during the war of the Revolution by Col. Aaron Hobart, who erected an air furnace, and prior to the war he engaged in the casting of church bells, while at the Hanover forge the first anchors of the famous frigate *Constitution* were forged.

About 1722, an iron forge was set up at Bridgewater, and sixteen years later the first trip hammer was placed in operation in that town by Hon. Hugh Orr, who, in 1748, made 500 stands of arms for the Province of Massachusetts Bay—the first muskets ever produced in this country. Most of these were taken by the British when they evacuated Boston in the Revolution. His son, Robert Orr, established the plate shovel manufacture which, in later years, under the progressive management of the famous Ames family, of Easton, has become one of the most extensive and celebrated industries of Southeastern Massachusetts.

By 1750 the rapid growth of the colonial industries met with rigorous restraining measures in the form of a prohibition of the further erection of slitting-mills, rolling mills and forges, as the King was becoming alarmed at the extent of production in the colonies. This inhibition called forth an immediate declaration of natural rights from the people of Massachusetts, but not until after the Revolution was a general resumption reached.

By 1810 the then existing rolling and slitting mills in the state were

largely engaged in manufacturing nail plates and rods for wrought nails, hoops, tires, sheet iron and sheet copper, and were located at Dover, where the Boston Iron & Nail Factory, composed of J. & S. Wales and R. Whiting, had its plant; at Plymouth, where a unit was owned by S. Spear, W. Davis, and N. Russell; one each in Beverly and Amesbury, owned in part by William and S. Gray, and one Osgood; one in Newton, owned by R. Ellis, General Elliott, and others; one at Norton; three in Taunton, one owned by Leonard & Crocker, and two at Bridgewater all rolling in the aggregate 3,500 tons annually, but having a capacity of 7,000 tons.

ABINGTON—FOR SIXTY YEARS A SHOE TOWN

For upwards of three score years Abington has been famous for shoe production, the original concerns such as those owned by M. S. Reed and Jenkins Brothers having passed out of existence, but in their stead have risen such an outstanding unit as the M. N. Arnold Shoe Company.

Moses N. Arnold, its founder, was born January 31, 1844, in Abington, the oldest son of a family of fifteen. His father and grandfather had both followed the calling of shoemaking, and when he was nine years old after having received a common school education, he, in turn, went to work as a shoemaker.

At the age of eighteen his career was interrupted by the Civil War, and eagerly responding to the first call for volunteers, he served with distinction in many notable engagements, including Cedar Mountain, Second Bull Run, South Mountain, Antietam, Fredericksburg, Chancellorsville, and Gettysburg, rising, in 1863, to the rank of captain, in which capacity he served on the staff of General Baxter. He was severely wounded in the battle of Antietam.

Upon his return from the war he resumed his position at the bench. Not content with his status, however, his energy and ambition soon began to assert themselves, and in 1865 he made and sold his first case of shoes.

This first case of shoes was manufactured in an attic room fitted up for the purpose in the old Arnold home, on Adams street, in North Abington.

By dint of untiring effort, his budding business steadily increased until, in 1867, he was forced to move to larger quarters, which he found in the shop formerly occupied by S. R. Wales. By 1870 he had outgrown these facilities, and the south part of the steam mill of Amos Read was fitted for shoe production and he moved to that location. Five years later the original building of the present Arnold factory was erected, and a four-story structure, 120 by 40 feet. This factory was added to from time to time as business increased, until it now consists of a large modern shoe plant of 131,350 square feet of floor space, equipped with the latest shoe machinery, affording work for approximately 400 employees and with a capacity of 1,500 pairs of men's and women's fine Goodyear welt shoes.

In the early days of the business boots were made exclusively and the company was famous for its California boots. The entire output was sold by the founder, who drove over the road with horse and wagon to Boston and returned with the leather for more production.

In time Moses N. Arnold was joined in the business by his brothers, William, Thomas and Wallace.

From 1875 to 1895 his product was sold exclusively to the wholesale or jobbing trade, both McKay and welt shoes being made.

In 1899, Moses N. Arnold's younger son, W. Percy, the present president and treasurer of the company, entered the business, having served his apprenticeship at the bench during odd moments after school and during his summer vacations.

He became connected with the sales end of the organization, and it was during this period that the company commenced selling shoes to the retail trade. Business at first came slowly in this new field, but gradually increased until at the present time the product of the company is sold entirely to retailers.

During this period, the leading shoe was sold under the brand "King Quality."

In 1910 the "Arnold Glove Grip Shoe" was developed and the construction patented. It embodied new scientific principles in manufacture, the objects of which were to aid and support the natural functions of the muscles of the arch of the foot in walking. The progress of this type was rapid and it now represents over 90 per cent of the total output of the concern.

In 1914 the company was incorporated under the laws of Massachusetts, with Moses N. Arnold, president; W. Percy Arnold, vice president; and James D. Arnold, treasurer. The original board of directors was composed of Moses N., William B., Thomas, Wallace W., James D., W. Percy, and Edward W. Arnold.

In 1919, W. Percy Arnold became president, and under his able management the company has steadily prospered. He is of the firm belief that a permanent business can be built up and maintained only through the quality of the product.

In 1914 the M. N. Arnold Shoe Company began the manufacture of women's Goodyear welt shoes, and after overcoming many difficulties the output of women's shoes was increased yearly until at present the production of the company is 40 per cent of that type.

Since 1922 exclusive Arnold Glove Grip stores have been established in the larger cities of the United States, and through these avenues, and the many retail shoe stores and department stores to which the company continues to sell footwear, the product of the M. N. Arnold Shoe Company has a nation-wide distribution.

Nine of the employees who moved from the mill of Amos Read with Moses N. Arnold, to the site of the present factory, are still in the employ of the company. During the entire life of the enterprise its relations with its employees have been most friendly, there never having been a labor dispute of any kind.

Malcolm P., oldest son of W. Percy Arnold, entered the employ of the company in 1922, having previously worked at the bench during his spare time and vacations, as had his father. After spending two years learning to run one machine after another in the plant, he became a foreman, later was made superintendent and in 1925 was elected vice president.

Dwight C. Arnold graduated from Massachusetts Institute of Technology in 1927 and entered the selling end of the business, and at present is stock department manager and retail store inventory control manager.

W. Percy Arnold, Jr., Mr. Arnold's youngest son, plans to enter the business after he has completed his college course.

The present officers of the company are: W. Percy Arnold, president and treasurer; Malcolm P. Arnold, vice president and superintendent; and Burton L. Wales, sales and advertising manager.

W. Percy, Malcolm P. and Dwight C. Arnold, with Burton L. Wales and Cecil B. Annett, constitute the present board of directors.

The company's Boston office is at 10 High Street, and its New York headquarters are at 127 Duane Street. It has capital of \$400,000 and employs 500 operatives.

C. H. Alden & Company, with capital of \$85,000, employs 200 operatives in the manufacture of men's and boys' shoes, and maintains a Boston office at 10 High Street. Charles H. Alden is president and treasurer and Stanley T. Drake is secretary.

Arnold Bros. & Co., owned by Charles H. Fitzpatrick, manufacture shoe lasts at North Abington, and the concern maintains a Boston office at 10 High Street. Sixty hands are employed.

W. S. O'Brien employs sixty operatives in the manufacture of shoe heels.

One of the plants of the Rockland Webbing Company is located in North Abington, where webbings are produced.

The plant of Bailey & Weston, Inc., is situated in Abington, where window shades, shade cloth and shade rollers are produced, the main office being at 83 Washington Street, North, Boston. H. E. Bailey is president and C. K. Thurston is treasurer of the concern.

The Plymouth Rock Ice Cream Company, of which Thomas F. McAnarney is president, and William J. Sheehan, secretary and treasurer, employs fifty operatives in the production of ice cream.

In 1928 the Bridgewater Workers Cooperative Association purchased a vacant factory, formerly occupied by the M. N. Arnold Shoe Company, and equipped it to take care of overflow orders which the concern was unable to fill at its Bridgewater plant.

The Abington Textile Machinery Works have capital of \$465,900, and employ 100 operatives in the manufacture of textile machinery. Sumner Smith is chairman of the board of trustees and John Macnair is treasurer and clerk.

The E. P. Reed Lumber Company, owned by Arthur B. Reed, employs twenty-five hands in producing builders' finish.

BRIDGEWATER—LONG FAMOUS FOR ITS IRON WORKS

In 1818 Bridgewater had three forges, two slitting mills, two anchor shops, four trip hammers, three nail factories and an air furnace, and on June 24 of that year, Samuel Rogers, who appears to have lived in Bridgewater at that time, but a few years earlier in Kingston, was granted a patent on a rolling mill for sheet iron.

On the present site of the Stanley Works plant, formerly known as the Bridgewater Iron Company, there was erected in 1785, the second slitting mill built in the colonies following the conclusion of peace after the Revolution. From 1810 to 1816 it was carried on by Lazell, Carey & Co., and in the latter year the firm became known as Lazell, Perkins & Co., this group continuing the business until 1825, when it became incorporated as the Bridgewater Iron Manufacturing Company, but continued to transact its business for years under the firm name of Lazell, Perkins & Co., which had become so well and favorably known to the trade.

The site was originally used as a saw and grist mill, and afterwards as a slitting mill and forging shop. The power was partly water and partly steam, a pond of some 300 acres in extent, adjoining the plant.

Originally producing nails, hoops, nail-rods and forgings, large additions were made to the machine shop and in 1830 the concern began the manufacture of steam engines, but a few years thereafter discontinued this branch to engage in the production of machinery for rolling mills, including soft and chilled rolls, housings, furnaces, hydraulic presses, sugar mills, nail machines, etc., and equipping their foundry for heavy castings.

The rolling mills produced tack, nail and shovel plates, two units being operated in producing these products, one driven by steam and the other by water power. There were two forges, one for making charcoal blooms, and the other for forging anchors, locomotive cranks, axles, and all kinds of forgings.

As early as the '50s the works employed 250 hands, and consumed 4,500 tons of coal, 6,000 tons of iron, and annually produced 50,000 casks of nails, and between 3,000 and 4,000 tons of machinery, plates and the like.

The plant at that time consisted of ten principal buildings, the concern owning some fifteen acres of land. The iron foundry, 50 by 140 feet, had a capacity of melting seven tons of ore daily, and contained a large oven for baking cores. Another building, 40 by 70 feet, was used for working scrap iron into blooms, and had a capacity of 300 tons per day.

The boiler shop, 30 by 40 feet, was used for the production of locomotives and boilers.

Another structure, 140 by 60 feet, was used for the manufacture of all kinds of wrought iron products, including locomotive cranks, car and engine axles and steamboat shafts.

The nail plate mill, 150 by 100 feet, had a capacity of fifteen tons per day, the nails being cut from rolls propelled by a 150 horse-power engine.

The structure containing the forty-four machines for cutting nails with a capacity of 1,200 kegs per week, was 140 by 45 feet in dimensions and had both water and steam power facilities of 60 horse-power each.

The rolling mill, a building 90 feet square, with a water wheel of 50 horse-power, had a capacity of rolling seven tons per day. The machine shop, 100 feet square, possessed an equipment for making machinery for rolling and other mill work of the heaviest kind, including hydraulic presses and nail and tack machines.

A fire-proof building, 45 by 90 feet, used as a storehouse, another structure in which water wheels were built and where also all the millwright work of the concern was done, together with a pattern shop, constituted the extensive plant, which was supplied with excellent transportation facilities by a spur track from the old Boston & Fall River Railroad.

NEW ENGLAND'S LARGEST IRON CONCERN IN 1875

With the advent of the railroad in 1846 the old Bridgewater Iron Company took its place as one of the largest and most important iron producing concerns in the United States, specializing in heavy castings, and forgings.

By 1875 it ranked as the largest iron concern in New England, its property then embracing seventy acres, ten of which were covered with buildings, in a part of which were housed two rolling mills, the largest

244 by 132 feet; two machine shops, of which the largest was 251 feet in length; two forges, one being 130 by 100 feet; an iron foundry, 130 by 90; a brass foundry, numerous storehouses, smith and pattern shops, comprising in all twenty-eight buildings, power being furnished at that time by five steam engines and eleven water wheels and the works annually consuming 15,000 tons of anthracite coal and 48,000 bushels of charcoal.

The company's forge department was distinctive, having facilities for producing heavy forgings that could be manufactured nowhere else in America. Here the shafts of the world's largest steamships were turned out. Here, too, for many years the heaviest forgings were made for the U. S. Navy Department, and here all the wrought-iron for John Ericsson's little Yankee cheese-box, the *Monitor*, was turned out, while a set of anchors for the old *Constitution* and the shafts and wrought-iron work of the new *Constitution*, weighing 250,000 pounds, were made, and all of the iron work for the entire fleet of the Pacific Mail Steamship was



NAHUM STETSON
of Bridgewater

For many years treasurer
of the internationally famous
Bridgewater Iron
Manufacturing Company,
now the Stanley Works

executed at the plant. The Stanley Works are a branch of the parent corporation, whose main plant and offices are in New Britain, Conn., the concern having capital of \$12,300,000. A small force of men is employed at the Bridgewater unit.

As early as 1823, the manufacture of paper was commenced by Joseph Hooper, who erected a mill, at Pratt Town, and who is said to have been the pioneer paper manufacturer in Plymouth County. In 1857, the Hollingsworth Company bought the plant.

In 1833, the manufacture of cotton gins was begun by the Eagle Cotton Gin Company, and about 1857, Bates, Hyde & Co, commenced the production of cotton gins, being succeeded by the Continental Cotton Gin Company, which later sold to the Eagle Company.

THE ROMANCE OF THE TACK

Save when we unceremoniously step upon an upturned tack while in a dishabille condition in the middle of the night, we rarely think of it as anything more than an insignificant product, but nevertheless there is as much of a romance surrounding the manufacture of these little articles as there is in connection with the development of electric turbines or Diesel engines.

Few are aware of the fact that from the beginning the tack industry has been largely centered in Southeastern Massachusetts, and that in sixteen plants located in Fairhaven, Brockton, Whitman, Kingston, Bridgewater, Plymouth and Hanover, with one in the Essex County City of Haverhill, approximately 3,000 tack making machines are turning out product that sell for more than \$5,000,000 a year. In all the rest of the United States there are but seventeen plants equipped with 1,230 tack making machines, and the estimated total volume of business done by these units does not exceed \$2,000,000 per annum. Here again, Massachusetts establishes its primacy in an industry whose individual product is so tiny as to be almost infinitesimal, yet in its service to mankind, its uses are beyond the power of computation.

Almost 75 per cent of all the tacks entering into commerce are created in Massachusetts plants.

The making of tacks, by hand, began early in the colonies. The first attempts were carried on by cutting up old iron hoops, into points, by using an imperfect type of shears, and placing these points in a common vise, for the purpose of heading each tack with a hammer. The mode was much improved when movable dies were placed in an iron frame, in the shape of an ox-bow, in the two ends of which were placed the dies, these being brought together by a lever pressed by the foot. By the first process a man might make 1,000 tacks daily; by the latter, 8,000 a day.

The industry which saw its rise in the town of Bridgewater, in 1786, when Ezekiel Reed, a native of the place, completed the invention of a machine for cutting cold tacks and nails, soon spread to the other Plymouth County towns, until by the end of the eighteenth century between 300 and 400 men and boys were employed in producing tacks in half a dozen localities.

Ezekiel Reed's first machine, which could not produce more than 3,000 tacks a day, was in constant use for thirty-seven years, and is now preserved in Abington.

Its operation consisted in the blank being cut with shears from a strip of hoop iron in a wedge shape piece, then placed in the jaw of the machine, point downward, and clamped firmly by pressure on the foot tread, enough of the material being allowed to protrude above the top of the jaw which, when flattened with a hammer, formed the head of the tack.

Reed made attempts to conceal the mechanism of his machine, but it was so simple, and the principle so easily applied, that it was quickly pirated, and came into general use.

JESSE REED PERFECTS HIS FATHER'S INVENTION

Jesse Reed, of Kingston, son of Ezekiel Reed, later produced a machine which made and headed the tacks in one operation at the rate of 6,000 per day, and in 1807 he patented his device.

Six years before, he had registered a patent for making nails out of heated rods, and between 1801 and 1825, Jesse Reed was granted ten patents, chiefly pertaining to cutting and heading tacks and nails, one granted in 1808 being for a wheel appliance used in the manufacturing process.

Melville Otis, of Bridgewater, claimed and received some consideration in perfecting the Reed machine.

The addition of nippers to Reed's device was the subject of a patent granted to S. Chubbuck, a Massachusetts inventor, in 1835. The patent

rights to Jesse Reed's nail machine, which completed the product in one operation, were purchased by a group of Massachusetts men, headed by Thomas Oldwine, and upwards of twenty machines were placed in operation, in Malden, while two other factories in the Schuylkill Valley, in Pennsylvania, were similarly outfitted. Fifty-two machines operated in these three establishments were capable of manufacturing 1,500 tons of nails annually, with the labor of sixty men and boys. Reed's machine was afterwards adapted by Oldwine to the work of cutting brads.

In 1825, Reed added a feeding apparatus to his tack machines, which were then being operated in Pembroke and Abington. In a report made to Congress by Hon. Albert Gallatin, Secretary of the U. S. Treasury, in 1815, covering the then prevailing manufactures of the country, the statement was carried that two-thirds of the total of iron flattened by machinery in the United States was used in the manufacture of cut nails, which industry had become an American institution by the substitution of machinery for manual labor, but the only specific instance cited in the report of the existence of a tack manufacturing enterprise was that of a factory in Bristol County, that was then producing 11,000,000 tacks annually. Presumably this concern was located in Taunton.

In 1807, Jonathan Ellis, a Massachusetts inventor and a partner of Jacob Perkins of Newburyport, was granted a patent on a machine for cutting brads and small nails, and G. Jenkins, of Plymouth County, was the recipient of a patent, in 1817, on a brad and sprig machine.

THE ROGERS AND BLANCHARD CONTRIBUTIONS

About 1815, Samuel Rogers, of Kingston, and Thomas Blanchard, of Millbury, were given a patent on a tack machine, originally designed by the latter, at an early age in his life, to relieve the tedium of the old process of cutting tacks from metal plates, and subsequently heading them one by one by the aid of a heading tool or clamp, attached to a lever operated by footpower, the head being flattened by one or more blows of a hammer. Seeking to abridge the labor of counting and weighing, which was his daily task when, as a boy, he worked in a tack factory, he contrived an ingenious counting machine, consisting of a ratchet wheel, which moved a tooth every time the heading tool grasped a tack, and by a bell indicated the completion of the allotted number. He began these inventions in 1806, when he was eighteen years of age, and for half a dozen years thereafter made many changes in the original model, finally evolving a completed machine which, history records, was sold by him for \$5,000.

For the exclusive right to the joint inventions of Jesse Reed, Rogers and Blanchard, the latter having bought Rogers' patent rights, Benjamin and Elihu Hobart, of Abington, paid \$30,000, about 1815, and began the manufacture of tacks there, and history records that 1,500,000 tacks were turned out in that town, in 1815. The price of the commodity was immediately reduced fifty per cent, and one operator could produce more tacks, on one of the patented machines, than fifteen could by hand, even if the latest improved mode of movable dies were used.

But they had scarcely begun to manufacture when, to their astonishment, they learned that a large consignment of tacks had come into the country, from England, and, upon investigation, they learned that a model

of the patented tack machine had been taken there, and patented in England, while the products had been sent here for sale.

They at once looked to the government for relief and protection, and, journeying to Washington, they referred the national legislators to the models in the U. S. Patent Office, pointed out the drop in prices effected by the machine manufacture, and secured the passage by Congress of a protective measure, which fixed the duty on imported tacks at five cents per 1,000, up to the 16-ounce size, and above that at five cents per pound, including brads and sparables. As iron and labor costs were lower in England than here, with no royalty on patent rights, competition would have been silenced in this country, and the consumers would have paid whatever price the English manufacturer fixed on his tacks.

Today, ONE modern machine, operating on the smaller sizes of tacks, eight hours a day, can produce 33,000,000 tacks a year, or twenty-two times as many as its 1815 prototype.

THE TACK MACHINE OF TODAY EMBODIES THE PRIMARY PRINCIPLE
OF THE ORIGINAL INVENTION

It is a tribute to the genius of these Massachusetts inventors that so complete was their grasp of the mechanical principles of the tack machine that the most up-to-date tack making device used today in plants in Massachusetts and elsewhere in the United States embodies the primary application of the original invention—a condition which prevails in but few lines of machine products.

With the exception of certain refinements of speed and application, the tack machine turned out as early as 1786 by Ezekiel Reed, perfected by his son a few years later, and adapted by Rogers and Blanchard, has not been materially improved upon to this day.

Roughly the average daily production of a 1930 tack making machine is about 60 pounds, or on a 300-day working schedule per year, 18,000 pounds on a single machine. With approximately 3,000 machines in operation in Massachusetts the total yearly production is in the vicinity of 54,000,000 pounds of tacks.

Fully 50 per cent of the product of the Massachusetts tack factories is used in manufacturing and repairing shoes, and so economical and efficient are the methods of our plants that at present prices the cost of nails and tacks used in making or repairing a pair of shoes does not exceed one cent per pair, a low figure when one considers how essential the product is in shoe construction. Massachusetts textile manufacturers, who lie awake nights trying to keep up with the change in styles, have a problem not unlike that which obsesses the tack producers of the Bay State, as changes in styles and customs materially affect the consumption of these little articles to a marked degree. When carpets were generally used, demand for tacks was universal; with the introduction of rugs the requirements tapered off. Changing designs in household furniture constantly cause fluctuations in the consumption of tacks. Changes in styles in shoes cause a varying consumption in this important source of marketing. The advent of the automobile is the latest important field of distribution, this factor showing striking gains year after year as millions of tacks enter into the upholstering of cars.

THE VARYING STYLE CHANGES IN TACKS

The tack manufacturer finds the same difference in the requirements of different sections of the country as the textile producer. Even when desired for the same purpose, what is required in one locality may be unsalable in another, where a different type of tack or nail is required for practically the same use. For shoe repairing, a small nail, round and corrugated, known to the trade as a "cobbler's nail," is almost exclusively used by repairers in the west and south, but in Philadelphia, New York and a few other large cities, the cobbler employs for the same purpose a small, flat, square cornered nail called a "channel nail." The cobbler's nail must be bright in finish; the channel nail must be blued. Just why the different finish is essential is an enigma to the tack manufacturer, and he does not inquire the reason, but supplies the product as requested. It is suspected, however, that the reason for this peculiarity may be racial. Formerly when shoe repairers were principally American born, or of German descent, only cobbler's nails were used, but the immigration of the past twenty-five or thirty years from Italy and Southern Europe altered the nationality of the shoe repairers, and the Italian and Greek artisan prefers channel nails, probably because that is the style used in their native lands.

Large quantities of cobbler's nails, plated with brass, are required in the South, due to the demand on the part of the negro population of that section. The brass plating produces a bright, attractive finish, but adds nothing to the durability of the product and is out of sight once the nail is driven into a shoe; but the barbaric tendency of the negro for bright colors and the brilliant golden beam, whether in gold teeth, or in "5 and 10" jewelry, is inherent in the African, and doubtless he believes that if his pedal extremities are encased in shoes replete with glittering nails he is paving the way for the wearing of "dem golden slippers with the angels bye and bye," as his old camp meeting song runs.

Carpet tacks are usually made with flat heads, but the Philadelphia demand requires oval heads, the reason for which is authoritatively said to be that many years ago a worthy scion of the City of Brotherly Love, while on a nightly visit to the cellar in quest of something not difficult to find before the days of the eighteenth amendment, inadvertently connected in his bare feet with an innocent and apparently innocuous upturned carpet tack lying in his path, and died of lockjaw. The Philadelphia newspapers devoted much attention to the carrying off of one of her favorite sons by such an unseemly route, and urged that carpet tacks should henceforth be produced with oval heads in order that they could not stand erect pointing upwards to the celestial realms and to the discomfort, injury and death of the populace. Thus a demand was created which has continued to this day and is one of the unique institutions of Philadelphia along with the daily scrubbing of the white marble door steps and the nocturnal partaking of scrapple.

The capacious maws of the tack machines in operation in the United States annually require about 75,000 tons of steel tack sheets which, with other raw materials and supplies, cost about \$3,000,000 per year. Today, the manufacture of tack making machines is almost exclusively in the hands of the Henry Perkins Company, of Bridgewater, which has capital of \$50,000 and employs about seventy-five operatives. In addition it pro-

duces nail machines and iron and brass castings. Charles Perkins is president, E. R. Perkins, vice president, and M. B. Perkins, treasurer and secretary. The company erected its original foundry, in 1854, and today it ranks as the largest producer of tack and nail machines in the United States.

THE GEORGE O. JENKINS COMPANY

George O. Jenkins, eighth in descent from Edward Jenkins, of Scituate, who had removed to the latter town, from Plymouth, in 1746, entered the employ of the late D. B. Gurney, in Bridgewater, in the early '70s, where, with his brother, the late Hiram H. Jenkins, he was employed in the steel shank department.

The Messrs. Jenkins invented and perfected a machine which cut, punched and formed the shanks in one process, where before, three distinct operations had been required.

The invention proved so valuable that in 1872 they engaged in business for themselves, and other manufacturers of shanks desiring to use the Jenkins method paid royalties to the inventors for many years for the use of the patent. The first year's business of the George O. Jenkins Company developed into an average of 150 gross per day, and in after years, as the Union Shank Company, which was owned by George O. Jenkins, the business became the largest in the world in the shank producing line.

In 1876 Jenkins Brothers also engaged in the manufacture of caskets, this business later becoming known as the Union Casket Company, which about 1891 was merged into a Boston corporation.

George O. Jenkins also became president of the Bingham Last Company, of Bingham, Me., which later became a part of the American Shoe Finding Company, of which corporation Mr. Jenkins became president, and later treasurer, and his son, H. Loring Jenkins, one of the directors.

In 1896, George O. Jenkins started a leatherboard unit, located on the site of one of the first, if not actually the original dam, built on the Taunton River, which had been constructed in 1792, to provide power for a grist mill. In 1823, a paper mill was built on this privilege, and the present plant of the George O. Jenkins Company stands on this site, the land having been recorded at one period in the name of Myles Standish. On the death of Mr. Jenkins, in 1916, the business was incorporated under the name of the George O. Jenkins Company, and it has become the largest manufacturer of leatherboard in the United States. In the distribution of its products, it does not merely depend upon the domestic market, but it has built up an extensive foreign trade. The company is capitalized for \$150,000, employs 100 operatives, and its present officers are R. A. Jenkins, president, G. O. Jenkins, Jr., vice president, Mrs. Abbie F. Jenkins, secretary, and H. Loring Jenkins, treasurer.

The founder of this concern was one of Whitman's self-made men, and an example of a poor boy, with but a common school education, becoming a power in the financial life of Plymouth County, and of the Commonwealth. As organizer of the Whitman Savings Bank, he became its president after the death of David B. Gurney, and much of the success of the institution was due to his business ability. The bank was the first in Massachusetts to put into operation the Massachusetts savings bank life insurance plan. He was one of the charter members of the Whitman National Bank, and served as one of its first directors, and he was a former

director of the Abington Savings Bank, and for nearly twenty years a director of the Puritan Trust Company of Boston, and a member of its executive board. He was the first president and the principal sponsor of the Brockton & Whitman Street Railway Co. and later became an organizer and director of the Rockland & Abington Street Railway Co. He erected upwards of fifty houses in Whitman, and with his brother, H. H. Jenkins, the largest business building in that town.

THE L. Q. WHITE COMPANY

The L. Q. White Shoe Company, now one of the largest producers in footwear of the wholesale trade in Massachusetts, the greater proportion of its commodities being marketed to chain stores and mail order houses, is another twentieth century enterprise. The founder, L. Q. White, was employed in the shoe factory owned by his uncle, Frank E. White, in Brockton, after school hours and during vacations periods, and upon reaching the age of twenty-one years, started in the wholesale shoe business, in New York City, where he remained for three years, returning to Massachusetts to assume an interest in his uncle's factory. Later the Frank E. White Company became the White-Dunham Company, until it liquidated, in 1906.

In the fall of that year, L. Q. White started shoe manufacturing, in Brockton, removing to Bridgewater, three years later, and he has since been associated with his brother, George B. White, and his son, Ralph W. White, in the L. Q. White Shoe Company, capitalized at \$1,000,000, and employing 2,000 hands, the concern taking rank as Bridgewater's largest industry.

OTHER BRIDGEWATER CONCERNS

The Bridgewater Brick Company, of which David V. Andrews is president and Henry W. Redfield, treasurer, operates three plants in Bridgewater, East Bridgewater and Taunton.

The Bridgewater Workers Cooperative Association has capital of \$250,000 and employs 200 operatives, in the manufacture of shoes. An auxiliary plant is also owned and operated by the concern in North Abington. Alexander Baginskas is president, Peter Budrums, treasurer, Anthony Cereiko, vice president, and William Tamull, secretary.

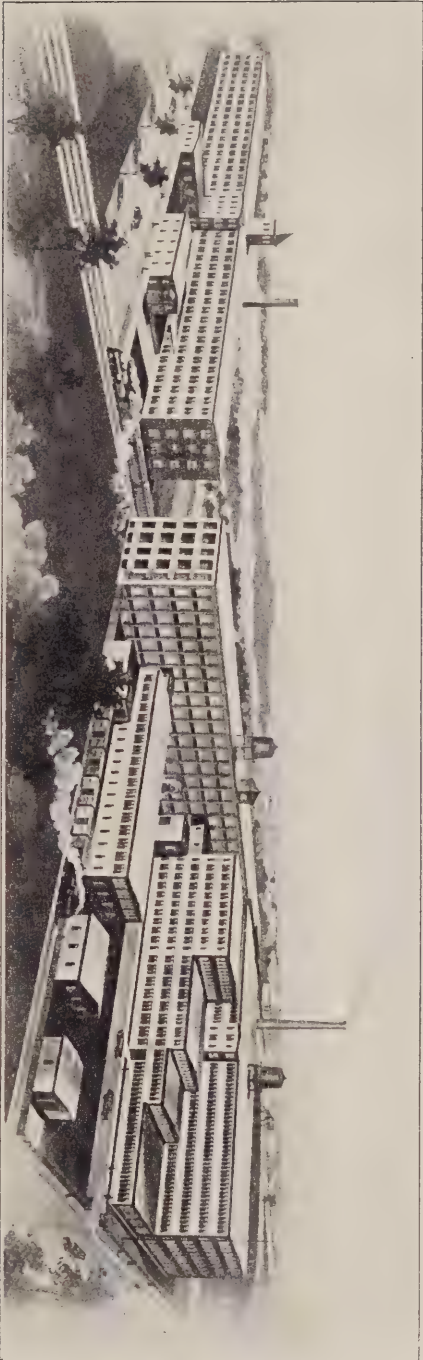
The E. L. Cook Brick Company has capital of \$100,000 and employs eighty operatives in the manufacture of common brick. Georgiana M. Cook is president and Sylvia C. Brown is vice president.

The Greenwich Leather Board Company, of 46 Lincoln Street, Boston, operates its heel board plant in Bridgewater, the concern having capital of \$100,000. Wm. B. Martineau is president and treasurer, and G. M. Whittier, clerk. The Independent Nail & Packing Co. is engaged in the production of nails.

The Independent Nail and Packing Company employs fifty operatives in the manufacture of wire nails. George W. Folsom is president and secretary, George C. Stone, vice president, and H. A. Stone, treasurer.

Jessop & Neale, a partnership made up of Joseph L. Jessop and Alfred Neal, manufactures brass, bronze and aluminum castings.

The Tenney Company, with capital of \$100,000, manufactures food products. Frank E. Tenney is president, and Charles M. Young, secretary and treasurer.



PLANT OF L. Q. WHITE SHOE COMPANY, BRIDGEWATER

CARVER MAKES AMERICA'S FIRST CAST-IRON KETTLE

In 1730 iron works were erected at Plympton, and in that part of the town now included in Carver, the first cast-iron tea-kettle produced in America was manufactured between 1760 and 1765. In 1813, a cotton mill was erected in the town and the following year a cotton and woolen factory began operations there, which used 15,000 pounds of wool a year. As early as 1756, a score of citizens of Plymouth County erected a blast furnace at the mouth of Assawampset Pond, at South Carver, about ten miles from Plymouth, locating the enterprise there because of proximity to bog ore beds, the abundance of pine forests, from which an unlimited supply of charcoal could be secured, and lastly, good water power, the works being known as the Charlotte Furnace.

During the Revolution the Colonial Government was supplied with solid shot fabricated out of the ore taken from the bed of the pond and dragged from its watery location by a device similar to an oyster dredge. The shot and shell used by the frigate *Constitution* in her memorable engagement with the *Guerriere* were also made here. Not until 1832 was the plant converted into a cupola furnace, and later a foundry, machine shop, warehouse and auxiliary structure were erected, and cook stoves, parlor grates, broilers, etc., were turned out by a force of seventy-five employees.

About 1747 the first rolling and slitting mill was erected in Middleboro, and in a census taken three years later two were in operation in that town, and one each in Hanover and Milton. The Hanover unit was established in 1704, while the famous Barstow Forge, in the same town, was set up in 1720. Wareham, Halifax, Dighton, Weymouth and probably other towns in Eastern Massachusetts were eagerly engaged in various types of iron manufacture and by 1798 the counties of Plymouth and Bristol were operating fourteen blast and six air furnaces, twenty forges and seven rolling and slitting mills, in addition to a number of trip-hammers and a sizeable total of nail and smith shops.

ELEAZER CARVER'S CONTRIBUTION TO THE COTTON GIN

As early as 1829 thirteen water privileges were in operation in East Bridgewater, furnishing power to the plants where tacks or nails, or both, were manufactured.

In 1838, Eleazer Carver obtained a patent on a new grate, so constructed as to entirely prevent cotton from clogging in the cotton gin—the first major improvement made on Eli Whitney's revolutionary machine invented by him forty-five years before, and in 1842, Mr. Carver formed the East Bridgewater Manufacturing Company—afterwards known as the Whitman Mills and since 1872, when it was incorporated, as the Carver Cotton Gin Company, where he began the building of improved cotton gins. In 1845, Mr. Carver secured another patent covering cylinder brushes for his cotton gin, and, in 1853, the government of India awarded him a prize of 2,500 rupees and presented the company with a gold medal in recognition of its production of unexcelled machinery for cleansing cotton from the seed. The concern today employs 350 operatives, has capital of \$900,000, is the largest local manufacturing enterprise, and is managed by Benjamin N. Johnson, president, C. W. Mercer, secretary, and Edward Hobart, treasurer. It takes rank as being the oldest unit of its kind in the

world, and in addition to producing complete cotton ginning outfits, it manufactures cotton seed oil machinery, special machinery and box board machines.

In 1851 locomotives were built in the town and chain works were established there in 1870.

Out of East Bridgewater there went during the period of the Civil War upwards of 300,000 pairs of shoes for the Union army, the manufacture of these commodities having been commenced at the village known as Joppa, as early as 1830.

In 1902 the Old Colony Foundry Company bought the plant built in 1850 by James Brown and James Eaton, who, two years before, had erected a sawmill and a wooden box factory, as well as a grist mill, machine shop and tack plant, the latter having been operated by Zenas and Scott Keith.

In 1851 all the units were sold to the Matfield Manufacturing Company, which increased the facilities and began the production of locomotives, of which but two were built. In 1870 the entire property was sold to Fearing, Rodman & Swift, and the manufacture of chains was carried on by that concern. Two years later, Moses Bates purchased the foundry unit and a two-story building in which were located the cleaning room, pattern shop, the storage department, and the office, and about two years later he disposed of these structures to Cephas Perry and Joshua Dean. In 1876 Perry sold his half interest to Dean, who continued to operate the foundry until 1902, when the Old Colony Foundry Company acquired it.

The plant has been rebuilt and enlarged several times in the last twenty-eight years, and the only part of the original foundry that is still standing are the brick walls of the first foundry building.

Charles L. Nutter is treasurer and manager, R. W. Nutter, president, and C. R. Bell, secretary. Upwards of 150 employees are engaged in producing iron and brass castings and the corporation has capital of \$125,000.

The Massachusetts Brick Corporation, large producers of brick for all purposes, and the Field Bros. Shoe Company, which in 1927 removed from Middleboro, to a new brick and cement factory, containing 16,000 square feet, which it built in East Bridgewater that year, complete the industrial picture of the town. The latter concern is quite extensively engaged in the distribution of its products in Germany, Austria, and Russia, is capitalized for \$100,000 and employs upwards of one hundred operatives. Walter Preston Field is president and treasurer, Ernest E. Field, vice president, Charles J. Grady, assistant treasurer, and Horace L. Mitchell, secretary of the corporation.

THE INDUSTRIES OF HANOVER

Hanover's early forge was followed in 1704 by an iron works unit, where were produced ship anchors, weighing up to five tons. The local manufacture of tacks began in 1830, followed by the production of plows and shoes. In 1875 the value of the latter product reached \$142,488, or some \$50,000 more than the figures of ten years before.

The town famous for so many decades as the center of shipbuilding operations, carried on along the banks of the old North River, now devotes its industrial activities to the production of shoes, rubber goods,

tacks, nails, fireworks and wooden packing cases, the firm of Lot Phillips & Company, at West Hanover, being the oldest established local unit.

It was founded by Lot Phillips and E. Y. Perry, in 1871, for the purpose of grinding corn, sawing lumber and making wooden boxes. Mr. Perry was the builder of the Hanover Branch of the Old Colony R. R., and having completed the road he desired to create freight business for it. His partner, Mr. Phillips, has built up and maintained one of the most modern box mills in the state. The Lot Phillips & Co. corporation has capital of \$60,000 and employs fifty hands. Lot Phillips is president and Fred W. Phillips, secretary and treasurer.

THE R. C. WATERMAN CO.

Project Dale, on the Indian Head River, located at South Hanover, is the habitat of the factory of the R. C. Waterman Company, manufacturers of the well-known L. C. Waterman & Sons and Hanover Tack Company brands of tacks.

The water privilege is one of the oldest in the state, the dam, according to the best information available, having been built between 1650 and 1700, while the privilege became operative in 1726.

That year, Nathaniel Josselyn sold to Joseph Smith one-half acre of land, partly in Scituate (now Hanover) and partly in Pembroke, on both sides of the Indian Head River, with the dam already constructed thereon. Smith was granted full liberty "to build and ever improve a fulling-mill thereon and use the water as occasion may require." Josselyn reserved the right to erect a grist mill for his own use or any other plant that would not jeopardize the fulling-mill which later venture was to have the right to use the water every Wednesday forever. On other days of the week, when the water was scarce, Josselyn was to have the first right to its use and when there was a plentiful supply both mills were to enjoy its use. In 1728 Frances Josselyn, administratrix of the estate of Nathaniel, sold to Joseph Smith and James Torrey, four acres of land, with dwelling house, and one-third of the dam, together with all the timber that had been prepared for a grist mill, lying on the Indian Head River.

How long the fulling-mill was operated is problematical, but the grist mill was used as late as 1856, as in a deed of the property executed that year the corn mill as well as the tack factory were described.

The present tack mill, built in 1920, is the successor to the old factory erected in 1829 by Elihu Hobart, who formed a partnership with E. Y. Perry, and carried on the business until 1850 when Mr. Perry became the sole owner.

He disposed of his interests to George Curtis, who a few years afterward sold the business to Lemuel C. and Rodolphus C. Waterman, father and son, the latter carrying on the business until 1916, when his heirs sold the assets to Morrill A. Phillips, owner of two factories located further up the Indian Head River. Mr. Phillips was the son of Ezra Phillips, who, with E. Y. Perry, was one of the pioneers in the tack industry of Massachusetts.

The present owners, who are Mr. Phillips' heirs, incorporated the R. C. Waterman Company in 1918. On April 19, 1920, the old factory was completely destroyed by fire and the present plant was immediately

constructed. It is of moderate size and one of the best tack factories in the United States, being equipped with hydro-electric power and the most modern scaling and bluing processes. There is no overhead shafting and belting, each machine being operated by an individual motor. The utmost care is taken in the manufacture of the product, which is evidenced by the reputation it holds in the principal fields of upholstery, carpet, gimp, trimmers and hide tacks.

C. T. Phillips is president, James R. Hall, vice president, F. W. Denio, secretary, Joseph W. Church, treasurer, and E. A. Bowker, assistant treasurer of the corporation, which employs fifteen operatives, and has capital of \$50,000.

THE E. H. CLAPP RUBBER COMPANY

Hanover holds rank as the birthplace of an important industry in the reclaiming of rubber from worn-out or obsolete manufactured goods, and fitting it for use a second time.

About 1871 Eugene H. Clapp began to reclaim rubber by mechanical means, in Hanover, and formed the E. H. Clapp Rubber Company, whose factory is located there, but whose main headquarters and offices are at 211 Congress Street, Boston.

To Mr. Clapp, perhaps more than any other man, is the success of this development due, and in the half century since his original experiments were carried on, the business has been placed on a sound commercial basis.

G. A. Clapp is president, and E. H. Clapp, treasurer of the E. H. Clapp Rubber Company, which has capital of \$299,600 and employs 250 operatives.

The Hanover Rubber Company was incorporated, December 1, 1913, and now has capital of \$50,000 common and \$40,000 preferred stock, and a surplus of \$58,400. Its West Hanover plant has a daily capacity of 60,000 pairs of rubber heels, 5,000 pairs of rubber soles, and 25,000 yards of rubber welt. The concern employs 160 operatives, and operates on a twenty-four hour schedule. It uses 200 steam horse-power and 750 electrical horse-power to operate its modern equipment. George J. J. Clark is president, Calvin J. Ellis, treasurer and manager, and they, with Stanley H. Clark, constitute the board of directors. The company's Boston office is at 10 High Street, but the main headquarters are at the plant.

The Industrial Lock Nut Company has capital of \$250,000 and is engaged in the manufacture of self-locking nuts. George P. Newton is president, George J. J. Clark, treasurer, and George F. Schnyer, secretary. Twenty-five hands are employed at the South Hanover plant.

The factories of the National Fireworks, Inc., are located at West Hanover, and afford employment to 350 operatives. The concern has capital of \$400,000. William A. Luce is president, William A. MacArthur, vice president, George W. Severance, secretary, and George J. J. Clark, treasurer.

Sam Salmond & Son, a partnership which includes A. L. Sylvester and the estate of J. S. Sylvester, employs forty operatives in the manufacture of all kinds of tacks.

The Joseph F. Corcoran Shoe Company, of Brockton, operates a branch plant in Hanover.

THE INDUSTRIAL RENAISSANCE OF THE TOWN OF HANSON

Hanson changed its early grist and sawmills and its forge into tacking establishments, beginning in 1828, and later was the seat of a number of small corporations engaged in producing this type of commodity. Hollow ware was also fabricated there about the same period.

At the beginning of this century had anybody suggested Cape Cod as being the center of thriving manufacturing establishments he would have been laughed at in derision, but today this little town with 2,000 population, is the seat not only of the Wheeler Reflector Company, capitalized for \$65,000 and employing 125 hands in the manufacture of reflectors, at its plant, located in the village of Burrage, and the John Foster Company, capitalized for \$50,000, employing seventy in the manufacture of wooden boxes and excelsior, and of which John L. Bates is president, Merritt F. Bates, clerk, and Theodore I. Hall, treasurer and general manager, but at South Hanson are the headquarters of the United Cape Cod Cranberry Company, capitalized for \$1,000,000, and employing in its units there and at Wareham, Carver and North Harwich, upwards of 1,000 persons in purveying fresh and canned cranberries to the world market.

The cranberry industry is as old as the Plymouth Colony, for the Pilgrims found the fruit growing wild upon the shores of Cape Cod, and were taught how to use the berries by the Indians. But for nearly three centuries thereafter, the industry had seen no radical changes or improvements, and only a spasmodic growth and development.

But in 1907, men of means, keen and alert to the advantages of safety in a real estate investment, and alive to the increasing popularity of a commodity which held great possibilities if properly produced and marketed, began to purchase available sites for cranberry bogs, and that year, Marcus L. Urann, a native of Maine, assumed the presidency of the United Cape Cod Cranberry Company, and with his genius for organization, brought together independent units, provided for scientific growing, irrigating, picking, packing and marketing, created central packing houses, installed machinery and equipment, and evolved methods of canning the fruit, until today more than a score of groups operate over a territory eighty miles long, from Brockton to Provincetown. The final consolidation of competing agencies was effected in 1914 and, in the years that have intervened, an increased income to the cranberry industry of Cape Cod of more than \$15,000,000 has been received by the growers.

There are now 1,000 growers of cranberries on Cape Cod, owning from a few acres each to the impressive holdings of the United Company, which owns 1,300 acres between Hanson and Harwich, being the largest grower and producer of cranberries in the world. After several years of research and study President Urann found that the canning of cranberries was not so much of a factory proposition as it was to select the right berries, and after experimenting in growing and producing the correct type for that purpose, he decided in 1920 to preserve the fruit.

YANKEE GENIUS ASSERTS ITSELF

A dozen years ago the marketing of Cape Cod cranberries was without orderly distribution in time or place and without brands or standards in quality or package. Then these hard-headed cranberry growers did the impossible by forming what is recognized as one of the most successful



ONE OF THE FIRST BUILDINGS USED BY THE UNITED CAPE
COD CRANBERRY COMPANY IN 1910



PACKING HOUSE OF THE UNITED CAPE COD
CRANBERRY COMPANY, 1915

organizations in the world, the Ocean Spray Preserving Company, which has spent in a decade \$1,500,000 in advertising its products.

Up to 1922, the annual sales of canned cranberries probably were less than 5,000 cases, and the product enjoyed none too good a reputation in the market.

The sponsors had overcome one after another of the various factors, which included saving the crop waste, then some 20 per cent; the marketing of a 100 per cent quality vine-ripened berry; effecting an all-the-year-round consumption; saving shrinkage in storage; growing heavier cropping varieties; making a manufacturing business out of the industry, and meeting the change in living conditions. The United Company finally presented a canned cranberry sauce to a suspicious and doubting public, as well as to a reluctant trade. That it was successful is evidenced by the fact that while the plant was designed to pack 5,000 cases, before the season was over it was increased three times, and 20,000 cases were canned. The sales rose in a five-year period from 5,000 cases to 350,000 cases a year, an increase in value of product translated into cold cash of \$900,000, and a saving effected by cooking while fresh, berries which otherwise would have become soft and unsalable, of \$400,000. In 1928 and 1929 the demand required the packing of 350,000 cases, of nearly \$1,600,000 in value, and the company distributes about 90 per cent of all the canned cranberry sauce made in the world, the product being exported to nineteen foreign countries, in 1919.

In addition, the corporation packs each year in the neighborhood of 15,000 to 20,000 barrels of fresh cranberries.

The great advantage of canning cranberries is that it permits the berries to remain on the vines until they are dead ripe, mellow and juicy, thereby permitting them to gain in value 100% because of the increase in the sugar content and in the development of the iron, iodine, manganese and other health giving properties of the delicious fruit.

The berry also gains in size, one sixteenth of an inch, which on Cape Cod, means \$900,000 in value.

It is figured that when the Cape Cod crop is canned, it means an additional income of \$2,000,000 per year, just from the economic advantages obtainable by the process.

Whereas previously the market for the Cape Cod cranberry was limited to that comparatively small area served with fresh cranberries, it embraces the world since the advent of the canned fruit.

President Urann was encouraged and supported by a group of loyal New Englanders, including Victor and Leslie Friend, Frank J. Whitney, Elmer G. Childs, William E. Hall, Francis and Robert Sim, Eugene Danforth, and others, in his efforts to place the cranberry industry on the firm basis where it rests today.

The canning of cranberries, as carried on by the United Company, means the movement of 5,000 carloads of freight, the use of 4,000,000 pounds of sugar, 4,000,000 New England made boxes, \$1,000,000 more in payrolls to Massachusetts employees and an annual turn-over of \$12,000,000 in manufacturing and sales of this food product.

THE COMPANY REFUSES TO SELL TO OUTSIDERS

No doubt exists that if this cranberry canning project had been evolved "out west" the noise raised about it would split the Rocky Mountains, but



HARWICH CANNING PLANT OF THE UNITED CAPE COD
CRANBERRY COMPANY



THE CRANBERRY PACKING HOUSE AND CANNING FACTORY OF THE
UNITED CAPE COD CRANBERRY COMPANY, SOUTH HANSON
Erected in 1912

its success has been so marked that early in 1927 the control of the industry was sought by New Jersey interests, backed by New York bankers, who proposed a \$4,000,000 cranberry merger.

Reliable reports are that the United Cape Cod Cranberry Company was offered above \$2,000,000 for its holdings, but, true to New England spirit and tradition, the proposition was refused.

President Urann, in replying to the promoters, clearly expressed the attitude of the progressive industrialists of Massachusetts, when he said: "What this company is and the service it may render is due to the fine example set us by sturdy, faithful New Englanders—to the wonderful cooperation of those who supply us with materials, including the railroads—to the skill of the jobbers and other buyers of our products and to the loyal devotion of those who have supplied money or labor to make the cranberry industry most useful as a source of food and of the most value to New England industry. This Cape Cod industry supplies from \$3,000,000 to



WAREHAM PLANT OF THE UNITED CAPE COD
CRANBERRY COMPANY, 1928

\$4,000,000 worth of food annually. We know it can be increased to \$6,000,000 by canning organization, by standardization, and by economy and efficiency.

"He who undertakes to supply food assumes an obligation and responsibility. We are entitled and will receive fair compensation for the capital, brains and labor employed. We are not sure that these objects will be better assured or promoted and we doubt if they will be sought with as great determination by this syndicate as by New Englanders themselves, who hold this cranberry industry a natural resource, and who believe that success is measured by what we give—not get out of, life.

"Our money shall have its usury; our labor shall be well paid, but our contribution to society shall be a pure cranberry sauce of the highest quality and lowest cost to consumers.

"We are searching for those who are willing to help carry on in this spirit, but there is no syndicate large enough to buy us out unless we are assured they can do this job better than it is now being accomplished.

"Purpose, power and peace are the sure steps in a well spent life. It should be the same with corporations as with individuals. Even money has a soul—the soul of its owner, accepting just two emotions in life, Decision and Execution, with not one second between them. We intend to press on with New England's richest heritage—the conscience and tradition of its past."

And so this great New England industry—a source of food, an opportunity for investment and a use for labor was saved to New England.

While the United Company now sells its goods to 3,000 customers located in substantially all the markets of the United States as well as in foreign lands, the potential distribution of its products is almost limitless. If the American canners of sour cherries are able to develop the sale of more than 2,000,00 cases of their product, which is largely used for making pies in the corn belt of the United States, there ought not be great difficulty in developing a market for 2,000,000 cases of canned cranberries annually.

The company expends \$75,000 a year in advertising its products, and in 1928, erected a large central packing house at North Harwich, which is operated as a community center, and to which all growers in that vicinity bring their berries, pool their shipments to make up carload orders for the fresh fruit, and unite in grading, packing and shipping the annual surplus supply. It also built the same year a substantial addition to its Onset plant, which added 100,000 barrels capacity to its canning operations.

Marcus L. Urann is president and manager and Carl B. Urann, assistant manager. The company's field office and main canning plant is at South Hanson, and its properties are located in Carver, Hanson, Halifax, Harwich, Wareham, Pembroke, Plympton, Plymouth, Middleboro and Bridgewater.

HANSON—THE STATE'S ONLY PRODUCER OF INDUSTRIAL LIGHTING EQUIPMENT

The Wheeler Reflector Company, incorporated in 1881, is the pioneer reflector manufacturer in the United States and the only manufacturer of industrial lighting equipment in Massachusetts.

In producing only porcelain enameled steel reflectors the company has developed a consistency in quality and progress in design which has enabled it to increase its business from a small shop to a large plant in manufacturing lighting units that meet every industrial lighting need.

The plant enjoys the advantage of being located in a small town which has been built around it. Labor conditions are excellent, since employees can live within an easy walking distance. The village of Burrage, in Hanson, where the factory is located, is but twenty-six miles from Boston, and only a short distance from Brockton.

Shipping facilities are excellent, and freight cars leave the plant daily. An ample stock of all popular items is carried at the factory.

The Boston office of the corporation is located at 275 Congress Street. H. C. Hawks is president, G. J. Henry, vice president, and Russell Burrage, secretary and treasurer of the corporation.

HINGHAM HAS FEW INDUSTRIES

John Baker established a factory for the manufacture of carriage trimmings in Hingham, in 1835, which took rank among the oldest and most extensive of its kind in the United States. There were two main buildings, each 100 by 25 feet, with a dye house attached, and employment was afforded to between 100 and 200 hands, the products being fringes, cords, tassels and upholstery goods. Mr. Baker was succeeded by James L. Baker, E. W. Burr, B. F. Brown, and E. Fearing under the firm name of Burr, Brown & Co.

Today, the Plymouth Quarries, Inc., engaged in granite production, capitalized for \$50,000, employing fifty-five hands, managed by George C. Treadwell, president; Harold G. Chatfield, vice president and treasurer, and Hugh Bain, secretary; The Rhodes & Ripley Clothing Company, capitalized for \$225,000, and engaged in the manufacture of clothing, managed by William Ripley, president; H. O. Rocheleau, vice president, and E. Rhodes Ripley, treasurer, and a branch of The Scully Company of Cambridge, sand and gravel producers, constitute the local industries.

KINGSTON'S PART IN MANUFACTURING

About 1751, a large body of bog-ore was discovered by Joseph Holmes, while angling in Jones River Pond, in Kingston or Plympton, and large quantities were for several years taken for the use of a forge. The ore yielded about twenty-five per cent of iron, which became widely known as "Holmes' Iron," and which provided material for cannon-shot during the Revolution. The forge site, three-quarters of a mile from the Plympton station of the Old Colony Division, of the New Haven road, is now known as Holmes' Anchor Forge, to which use it was afterward converted, and was equipped with a charcoal fire, four forge fires, and two hammers driven by water. It ranked among the oldest works in the country, and, with another anchor forge, a mile from the Kingston depot, erected in 1792, as an edge-tool factory, and changed to an anchor forge in 1800, was owned by a descendant of the original proprietor for many years.

The introduction of the art of casting in sand, in place of clay moulds, is ascribed to Jeremy Florio, an ingenious Englishman, who practiced it at Kingston, previous to his death, in Plympton, in 1755.

A rolling and slitting mill was in operation in the town as early as 1795, and the James River Cotton Manufacturing Company was established there in 1812.

Some of the first experiments in America with anthracite coal are said to have been carried on in Kingston, early in the nineteenth century.

Forges, iron works, screw auger plants, tack and rivet units, and a cotton factory were operated in Kingston, at various times during the last century.

C. DREW & COMPANY

The firm of C. Drew & Company, of Kingston, provides another of the many proofs that changing economic conditions constitute no reason for a concern to abandon its activities. Established in 1837, the Drew firm carried on the manufacture of wooden shipbuilding tools, augers, calking irons, mallets, etc., for nearly a century, but with the decline of the construction of wooden ships and the consequent loss of its potential market, it did not retire from business, but turned its plant into the production of mechanics' tools.

The present partnership is made up of C. H. and C. R. Drew, and R. E. and W. D. Ford, and fifteen hands are employed.

COBB & DREW, INCORPORATED

The vital changes in manufacturing methods are emphasized in the story of Cobb & Drew, Inc. When in 1848, Benjamin Cobb and William R. Drew, of Plymouth, bought the Old Colony Foundry Company, which had been manufacturing stoves, at the site adjacent to Old Foundry Pond, the

iron supply was being drawn from the marshes and ponds in the vicinity. At that period "rights to take iron-mine" were granted by the towns and ore was secured by employees who waded close to the shore, or who worked from boats in deeper water. It is related that in 1751, while fishing in Jones River Pond, Joseph Holmes brought up a piece of ore, which had caught on his hook, and thereupon a new source of raw material was discovered. From the early furnaces, grew the tack and nail works, which were so numerous in the vicinity of Plymouth, at the outset, Messrs. Cobb and Drew added the manufacture of tacks, but later began the production of rivets, fashioned from Norway or Swedish iron, which raw materials they imported for many years. In a limited way, they still utilize several carloads of this type of iron, but, with the discovery of the Bessemer and open hearth processes for the manufacture of steel, a new source of supply was developed.

Today, Cobb & Drew, Inc., is the largest producer of rivets in New England, the commodities being manufactured by automatic machines. Burrs, washers, staples and spring cotters were later added. "Plymouth Rivets" have been marketed throughout the United States for the greater part of the eighty years of existence of the original firm, and its corporate successor, which came into being, in 1907; capitalized for \$100,000 the concern regularly employs fifty-five operatives at its factory on Foun-dry Pond, in Kingston, at which location it has carried on business for more than seventy years.

Close adherence to the old-time standards of courtesy and fairness; demonstrating a friendly spirit towards every customer; the exercise of the utmost care in producing commodities that will satisfy the trade—these are the principles which have made this institution well and favorably known among the trade.

Charles A. Bumpus is president, Frank C. Smith, treasurer and secretary, and Thomas S. Fogarty, purchasing agent.

THE MAYFLOWER WORSTED COMPANY

In 1919 the Mayflower Worsted Company was incorporated, and today has capital of \$207,400. From its inception it has manufactured men's wear fine worsteds, and the enterprise has attained a reputation in the textile field second to none, the company's products being considered by American tailors to be the equal in fineness of texture, permanency of colors and purity of materials to the finest fabrics imported from abroad.

Here is a concern in a little town of 2,500 that affords constant employment to upwards of 175 operatives. Morton Collingwood is president, Joseph T. Collingwood, treasurer and Donald Collingwood, secretary, and the corporation operates a selling agency at 200 Fifth Avenue, New York City, where Donald Collingwood and Charles J. Craig have charge of sales. The modern plant is equipped with the latest machinery. The company began business in a wooden building, with ten looms and finishing machines, but brick and cement structures have supplanted the original plant, and today the corporation operates 37 looms. Hydro-electric power is generated at its water privilege, on the Jones River, at the site formerly known as the Anchor Forge, and it also utilizes this water supply in washing the fabrics it produces.

THE MENDELL ELECTRIC MANUFACTURING COMPANY, INCORPORATED

The present-day Mendell Electric Manufacturing Company, Inc., of Mattapoisett, was first known as the W. S. Hill Electric Company of Boston and New Bedford. It was a pioneer in the manufacture of jack knife switches, and constituted the electrical department of the Taunton-New Bedford Copper Company, of Taunton, in 1909. In 1915 the name was changed to Mendell Manufacturing Company, Inc., with headquarters in New Bedford, and in 1918 the plant was moved to Mattapoisett.

In 1926 the name was again changed to the Mendell Electric Manufacturing Company, Inc., at which time it engaged in the production of a full line of electric switch apparatus, panel boards, steel cabinets, and switchboards.

Clark W. Holcomb is president, Henry C. Holcomb, secretary, and John M. Lancaster, treasurer, and the company is capitalized for \$30,000. Thirty hands are employed.

THE LURE OF THE NEMASKET RIVER

The Nemasket River drew to the town of Middleboro many manufacturers who established themselves on its banks about the beginning of the nineteenth century, and operated a cotton mill, a wool carding plant, woolen mills, and a forge where shovels were produced.

Just a hundred years ago the first of the straw shops were built in Middleboro. They flourished for many years thereafter, all sewing being done by hand where today it is accomplished by machinery. Middleboro no longer is a straw hat center as of yore, but its busy plants are mainly devoted to shoe production, paper and wooden boxes, jewelry and motorized fire apparatus.

THE PIONEER NEW ENGLAND BRONZE PRODUCING CONCERN

The Colonial Brass Company of Middleboro, was established in 1845, but was not incorporated until 1917. The concern was the first New England manufacturer of bronze work and it now specializes in architectural and ornamental bronzes for banks and other institutions, advertising signs and bronze nameplates for machinery. It also produces a most complete and artistic line of bronze sun dials, which find their way into many formal gardens throughout the United States.

Its high quality products owe no small part of their reputation to the fact that the company has been able to retain over a period of many years some of the most experienced and highly skilled bronze workers in New England, a number of the employees having followed the trade locally for decades.

The enterprise is a unit whose commodities add to the wide and unusual lines of specialties for which the industrial production of this Commonwealth is famous.

Its fifty artificers works not only in brass and bronze, but also in aluminum. The corporation has capital of \$150,000, and John J. McCarthy is president, Carl White, secretary, and William B. Crossley, treasurer.

THE MAXIM MOTOR COMPANY

The story of how Middleboro found its place in the industrial sun as the habitat of motor driven fire apparatus is one of the romantic chapters of Massachusetts industry.

A little over four decades ago C. W. Maxim established a modest wood-working business, which grew year by year until it became not only successful, but well-known throughout southeastern Massachusetts. In the later years of the last century, when the pioneer automobiles appeared, Mr. Maxim purchased one of the first cars that were sold outside of Boston, and soon he interested a number of his friends in the new fangled "horseless carriages," with the result that almost before he was aware of it he had added the selling and servicing of automobiles to his wood-working business, which by that period had developed into a specialty manufacturing enterprise, including the manufacture of engineering products and mechanical equipment.

It was at that stage that his son, Ernest L. Maxim entered the firm, and the manufacturing and automobile enterprises became a part of his every-day life. A few years later father and son reached the conclusion that the prospects in the automobile business were more alluring than in the wood-working trade, and the next most natural development was that of establishing one of the first commercial garages located outside of the Hub, which was first operated under the name of C. W. Maxim, and two or three years later as the Middleboro Automobile Exchange. Subsequently it became the Maxim Motor Company, the name it bears today, and C. W. Maxim has been its president from the beginning.

In April, 1914, the Messrs. Maxim reached the conclusion that as the manufacture of motor driven fire apparatus was of a custom, rather than a production business, it would be a logical step to launch such an industry in New England. They also appreciated the fact that as fire apparatus requires immediate repair service day and night, and many times direct factory service, an agency to which municipal authorities could turn without resorting to the delays incident to shipping fire trucks to the west, or to New York state, would be helpful to the New England situation.

Determining to produce nothing but high quality apparatus, they embarked upon the manufacture of fire engines and in fifteen years the business has grown until today upwards of 50,000 square feet of area are devoted to production, and the concern turns out from sixty to seventy-five engines each year, besides all types of fire department equipment and supplies, including fire ladders, mechanical devices, and the like.

Four years after the fire engine business was started the Maxim Motor Company was incorporated with C. W. Maxim as president, and Ernest L. Maxim, as treasurer.

All sizes and types of modern fire-fighting apparatus, including 1,000, 750, 600, and 500 gallon per minute pumping engines, four models and sizes of city service ladder trucks, and a large line of combination and hose wagons, are included in the company's regular line.

The corporation has capital of \$120,000, and employs 100 skilled men, at its Middleboro plant.

In 1906 the Nemasket Worsted Mills were incorporated, and are engaged in the manufacture of men's wear fancy worsteds. The corporation has capital of \$550,000, and employs 200 operatives.

G. B. Sanford is president, F. W. Reed, secretary and C. R. King, treasurer.

The Alger Paper Box Company operates factories in Middleboro and Brockton, where upwards of sixty operatives are employed in the manu-

facture of paper boxes. Milton W. Alger is president and secretary and J. W. Totten, treasurer of the corporation, which has capital of \$100,000.

Levi O. Atwood employs fifty hands in his factory located in the village of Rock, where wooden boxes, box shooks and packing cases are produced.

The Colonial Casket Company, of which Harry S. Rogers is president, W. H. Raymond, secretary, and W. B. Crossley, treasurer, has capital of \$50,000 and manufactures funeral supplies.

Two of the largest local industries are engaged in the production of men's and boys' shoes, Leonard & Barrows, Inc., with capital of \$275,000, employing 500 operatives in the manufacture of men's and boys' footwear. Charles W. Leonard is president, and Julian T. Leonard treasurer, they with Fletcher L. Barrows constituting the board of directors. The company maintains its Boston office, at 181 Essex Street.

Leonard, Shaw & Dean, Inc., produces men's Goodyear shoes, and employs 150 operatives. The corporation has capital of \$160,000. R. G. Hasty is president, S. F. Alger, vice president, Samuel Shaw, treasurer, and Chester L. Shaw, secretary. They, with G. E. Dean, are the directors of the concern.

The George E. Keith Company of Brockton operates a branch shoe factory in Middleboro.

Seventy-five employees are engaged in the manufacture of jewelry in the plant of William H. Luther & Son, Inc. The corporation has capital of \$50,000. O. P. Becker, Jr., is president, O. P. Becker, Sr., treasurer and M. E. Becker, clerk.

The Nemasket Press, Inc., of which Lorenzo Wood is president, Albert Deane, vice president, and A. L. Beals, treasurer and secretary, is engaged in printing and engraving.

The Henry B. Schlueter Company, owned by D. T. Burnett and E. C. Fales, manufactures trays and show cases for fountain pen displays. The same partners also operate the Faburn Manufacturing Company, manufacturing oil cans. David R. Walker is engaged in the production of ice bags and novelties, and employs fifteen operatives.

Better Boxes, Inc., with capital of \$50,000, manufactures boxes for fountain pens. E. E. Ralston is president and D. T. Burnett, treasurer.

The Lobl Manufacturing Company has capital of \$250,000 and employs fifty hands in the manufacture of druggists' sundries. It maintains a sales office at 405 Flat Iron Building, New York City. William Simon is president and Frederick Lobl, treasurer.

The Winthrop Atkins Company is engaged in the production of colored photographs.

PEMBROKE PREFERRED HERRING TO SHOVELS

In the early years of the nineteenth century the town of Pembroke was the center of numerous small manufacturing enterprises, bricks being made there, beginning about 1800; beaver hats from 1800 to 1820; satinets from 1813 to 1834; cotton goods from 1812 to about 1835 and boxes from 1835 to the end of the century, this industry constituting until recently the main line of local production. In 1867 a shoe manufacturing concern employed 100 workers, but like many another Massachusetts municipality that thought more of a few herring, than of continued industrial prosperity, Pembroke lost its opportunities to become a manufacturing town

of permanence and renown by casting its die in favor of its puny fisheries rather than encouraging the advent into its midst of an industrial enterprise which was forced to locate elsewhere. When the late Oliver Ames, of Easton, was casting about for a location for the Ames Shovel & Tool Company, a corporation that today employs 1,200 hands, he opened negotiations for the purchase of the Glover Mill property, in Pembroke, but being informed that he must open his sluice ways for five or six weeks during the busiest period of each year, in order that the herring might run, he abandoned his option, and located his initial plant in Easton.

Today, the town's only industrial establishment is the Marine Compass Company, a corporation that today employs 1,200 hands, he opened new village of Bryantville. The concern is owned by L. A. Sherman, and a New York office is maintained at 460 Greenwich Street.

PLYMOUTH'S LARGEST INDUSTRY

Following the early grist and fulling mills, and copper shops, set up in Plymouth, various types of manufactures were established in the town, but it was not until a little more than a century ago that industries of size and importance were locally developed.

In January, 1824, a new tariff bill, increasing the duties over those that previously prevailed, was reported in the lower branch of Congress, and, after a long contest, was passed by a bare majority in each branch, and became a law on May 22nd, of that year.

By this act the duty on tarred cordage was raised to four cents a pound, and on untarred cordage to five cents per pound, while the duty on unmanufactured hemp was fixed at \$35 per ton. The passage of this bill not improbably determined the birth of the Plymouth Cordage Company, now more than a hundred years old.

That the previous protective tariff acts had produced good results is attested by what Hon. Edward Everett, then a professor at Harvard, said in an oration delivered at Plymouth, on the 204th anniversary of the landing of the Pilgrims, in December, 1824: "Within a few years what a happy change has taken place. The substantial clothing of our industrial classes is now the growth of our American soil and the texture of the American loom; the music of the water-wheel is heard on the banks of one thousand rural streams, and enterprise and skill with wealth, refinement, and prosperity in their wake, having studded the seashore with populous cities, all making their great progress of improvement through the interior, and sowing towns and villages as it were broadcast through the country."

Seven of the rope walks at the North End of Boston had been destroyed by fire, in 1794, after which they were rebuilt and destroyed again in 1819, and it was in 1824 that Mayor Quincy caused them all to be removed from the marshes (now the Back Bay district) at an expense to the city of \$55,000.

The special difficulties of the Boston rope-walks perhaps further encouraged Bourne Spooner in his plan to establish a cordage plant in Plymouth. On June 12, 1824, he, with William Lovering, Jr., John Dodd, John Russell and others, was incorporated as the Plymouth Cordage Company, for the purpose of manufacturing cordage, and on August 21, 1824, Spooner conveyed to the corporation, for \$1,800, Jackson's grist mill on the farm of Barnabas Hedge, and a certain ancient mill privilege where

formerly stood a sawmill, on the road leading from Plymouth to Kingston.

Spooner's water privilege was on a small stream, hardly more than a brook, and it scarcely seems that he then entertained expectations of future growth of the enterprise, as his hopes could not have been comparable to those who started manufactories on the gigantic water powers at Lowell and Lawrence.

The Plymouth company began with capital of \$20,000, which was increased by successive steps in 1833, 1850, 1855, 1863, and 1883, to \$500,000 but all of the funds for these five additions came from special dividends of profits, thus increasing each single original share of stock to eleven and four-elevenths shares.

In 1894 the capital stock was doubled, being increased to \$1,000,000, and in the intervening years has grown to \$8,000,000. In 1832, seven and a half years after the company was organized the first dividend was paid, and with the exception of 1839, 1843 and 1858, the enterprise has paid one or more dividends each year, with a declaration of several stock dividends.

THE COMPANY OVERCOMES MANY DIFFICULTIES

The corporation has successfully weathered many crises in the industry, including a pooling arrangement entered into in 1878, which continued for nine years, and which, in the case of the Plymouth concern proved a blessing, rather than a liability, as it aided in tiding over the affairs of the concern following a disastrous fire at the plant on January 3, 1885, which badly crippled production until new buildings could be erected.

When a giant combination of all the cordage companies in the United States was proposed, in 1887, the directors of the Plymouth Cordage Company stood aloof, and their position was justified, as, six years later, The National Cordage Company, a merger of many of the larger companies in the industry, passed into the hands of receivers, and a like fate overtook the United States Cordage Company, two years later, this concern having been created out of the wreck of its predecessor.

In the period of great industrial depression in 1893, the Plymouth Cordage Company, which had sold enormous quantities of binder twine to a nationally known mowing and reaping machine company in the Middle West, the credit of which had been undoubted, suddenly found in the midst of the financial panic of that period, that a bill of over \$500,000 owed it by the concern in question could not be paid. At that period, the entire capital stock of the Plymouth concern was but half a million dollars; nobody could tell how much, if anything, of this debt its consignee would eventually be able to pay, and it was hardly the time for a corporation to borrow \$500,000 more than its ordinary requirements. However, if the amount could not be secured, the Plymouth Company realized it would be obliged to ask for extensions, or close its plant. Happily, the amount was borrowed, two of the directors and the treasurer endorsing the company's notes.

Eight years after the company began operations Thacher's local history of Plymouth alluded to the concern in these words: "Their rope-walk is situated in the north part of the town, near the Kingston line, is three stories high, and is capable of employing eighty hands and of making five



THE PLANT OF THE PLYMOUTH CORDAGE COMPANY, PLYMOUTH,
IN ITS EARLY DAYS



BIRD'S-EYE VIEW OF THE NORTH PLYMOUTH PLANT OF THE PLYMOUTH CORDAGE COMPANY

hundred tons of cordage per year. Their cordage is of the patent kind, is of high repute, and is laid by water power." Rope made without the use of a rope-walk was called "patent rope," to distinguish it from "rope-walk" rope.

In 1827 the sales of cordage made by the company amounted to 601,023 pounds, but not until 1837 was a steam engine installed, the twenty-horse-power provided by the meager Nathan Brook sufficing until that time.

The concern did not manufacture and market binder twine until 1882, when it put out 384,820 pounds. The last year of the nineteenth century it disposed of 27,905,981 pounds of that commodity, which amount, added to the sales of cordage, the same year, made a grand total of 47,503,625 pounds, or seventy-nine times as much as it had marketed 72 years before, in 1827.

While there are a great many cordage manufacturers in the United States, the production at Plymouth constitutes more than 15 per cent of the total.

THE INFLUENCE OF MACHINERY ON PRODUCTION

In the beginning the concern employed about 35 hands, and today it carries 2,000 workers on its payroll, but if the same methods used even as late as the eighties were now in vogue it would require at least three times the number of employees it carries on its present payrolls.

Machinery is now doing work which, if it could be done at all without mechanical devices, would require two additional operatives for every one now employed. Almost without exception the opponents of the introduction of machinery look only at the immediate effects. They fail to forecast ultimate results. Intricately indeed are the interests of different industries intertwined. The development of one in ways not anticipated in the beginning results in the rearing of others whose relationship may never have been contemplated.

In 1850 when railroad development was under way, the officers of the Plymouth Cordage Company probably visioned that this then new mode of transportation would enable the concern to reach a wider market with their product, but their perspective could not possibly have comprehended that, ere the close of the nineteenth century, the railroad, supplemented by sowing and reaping machines, and other mechanical appliances designed to advance agriculture, would render profitable the cultivation of wheat fields in the West, so vast in extent as to permit more than fifty per cent in weight of the company's products to be used simply to bind up the sheaves, nor could they foresee the phenomenal development of the boundless acreage of the Canadian Northwest to which locality the Plymouth Cordage Company annually sends unbroken trains of freight cars, loaded to the roof tops, with the binder twine for the agriculturists of that section of North America.

Labor-saving machinery has been one of the primary factors in bringing about the unequalled progress of this Commonwealth and the nation as well, and experience now proves unmistakably that its use has resulted not in contraction but in an ever widening enlargement of the field of labor, and in all instances has been accompanied by an increase in wages, while the purchasing power of a day's pay has also grown. Economy in production is progress and leads to greater prosperity, and he who opposes

it stands recorded as not only the enemy of labor but of the general welfare of mankind.

It can be said of the Plymouth Cordage Company that it is one of the few Massachusetts corporations where for four successive generations, without intermission, members of one family have been active and prominent in its affairs. Caleb Loring's name headed the original list of stockholders, and below it came that of his son, Charles G. Loring. Caleb was treasurer of the corporation during the first ten years of its existence, and Charles G. was clerk from 1824 to 1831, being succeeded by his brother, Francis C., from 1831 to 1845, when Caleb William Loring assumed the office and served for 39 years, until his son, Augustus P., was chosen clerk in 1884 and held the position until 1897, when he was elected president of the company, a position he still holds. The office of clerk of the corporation, therefore resided in four members of the Loring family for seventy-three years. In 1909, Augustus P. Loring presented to the company the Loring Library and reading room as a memorial to his father.

A HALF CENTURY OF DISTINGUISHED SERVICE

Like many another industrial corporation doing business in the Bay State incidents have occurred in the more than one hundred years of the existence of the Plymouth Cordage Company, which, at their happening, seemed of very ordinary importance, but which have been rendered remarkable and outstanding by their consequences.

On March 28, 1859, one such incident occurred—the company hired a new office boy—surely a common occurrence in the regular course of business. But because that fifteen-year-old boy chanced to be Gideon F. Holmes, there was held on March 28, 1909, a unique celebration to mark an occasion unusual even in the industrial annals of Massachusetts. The office boy, who, a half century before, began his duties under the watchful eye of the founder of the company, Bourne Spooner, rose to the highest executive position in the organization, and for a third of a century was its guiding power and moving spirit. Surrounded by 2,000 employees, stockholders and associates, Mr. Holmes was honored as perhaps no other Massachusetts industrialist has been in a generation.

The *Outlook*, in editorial comment on the affair, said: "The days have long gone by when the ultimate relation of master and apprentice can characterize industry. Those days cannot be restored. Steel machinery has brought into existence the organization of human machinery. Can that human machinery remain human? That is the question which many people looking on the conditions of today answer in the negative. There at North Plymouth, however, was an answer of another kind. The library, the woods within the factory grounds, the pleasant cottages, the bathing beach, the athletic grounds, the great hall, and such a social gathering, are something more than the investment that a wise dairyman makes in good stables. They are symbols of that fellowship in industry which can be restored, and, perhaps sooner than we think, be made truer and sounder because broader and more far-reaching than it ever was in the days of the hand worker. The man under whose direction and management a company has been able to seize upon and harness this spirit of fellowship in work has served the world well. His fifty years of service are as worthy of celebration as the fifty-year service of a minister or doctor or judge. Mr. Holmes and his colleagues have proved that the

manufacturer or merchant, as well as the minister or doctor or judge, can magnify his office."

When Mr. Holmes entered the employ of the company in 1859, it employed 118 hands and the annual product was 3,750,000 pounds; in 1882 when he became treasurer, 303 names were on the payroll, and the output was 12,000,000 pounds a year; when he completed his fiftieth year of service there were 1,625 hands employed, and the yearly output was 90,700,000 pounds.

The success of the Plymouth Cordage Company was not due to its location, in fact it may be said that it achieved success in spite of its location. Other corporations in the same industry much more favorably situated than it failed deplorably, but the Plymouth concern has had a longer life than any other cordage company in the United States, and in point of unchanged corporate existence it ranks among the very oldest industrial enterprises in the world.

Its great success has been due not to exceptional opportunities, nor to the elements of chance, but rather to the character, perseverance, brains and devotion of its officers and employees, and primarily and principally to the life work of Bourne Spooner and Gideon F. Holmes. In addition to the Plymouth plant, it operates a large unit at Welland, Canada.

Francis C. Holmes succeeded his father as treasurer and the fifth generation of the Loring family is represented on the directorate by Augustus P. Loring, Jr.

DESPATCHING SOLID TRAINLOADS OF BINDER TWINE

For several years past the Plymouth Cordage Company has annually despatched solid trainloads of binder twine out of North Plymouth to the Central West. This practice began in 1912 when word reached the officials of the Plymouth concern that a twine famine existed in the Canadian Northwest. Government officials presented a picture to the manufacturers of binder twine indicating that the crop could be saved that year only by immediate relief, and a train of thirteen cars, carrying 1,000 bales in each car, or a total of 650,000 pounds, left North Plymouth, accompanied by William P. Libby, the Traffic Manager of the Plymouth plant, at 3:45 p. m. on August 21 of that year and arrived at Montreal the following morning, where it was promptly routed over the rails of the Canadian Pacific to Winnipeg, as the second section of one of its Transcontinental passenger trains, and reached there at noon on August 24, a total run of 1,817 miles, which, allowing for the difference in time, was accomplished in 68 hours and 25 minutes—said to be a world's record for a long-distance freight train.

Every year, during the month of May, the Plymouth Cordage Company despatches several solid trains, varying from thirty to fifty cars that remain intact as train units as far as Buffalo, where they are split up to various lines operating West and Southwest from that city, and the movement of the cars is so expedited, that delivery at Chicago invariably takes place on the third day and at St. Louis on the fourth day after leaving Plymouth.

This method of handling Massachusetts industrial tonnage is simply the application of the idea of concentration to carload tonnage that is in vogue on less-than-carload lots. The Plymouth corporation finds the policy the most convenient way of handling its tonnage, as the New Haven

system takes the cars as a unit to Framingham, if routed New York Central Lines, or to Maybrook if routed via the other lines, and the connecting roads handle the trains through to the respective terminals, thus retaining their identity as solid movements without resorting to switching until Buffalo is reached.

PLYMOUTH ROPE GOES TO THE SOUTH POLE

When Commander Richard E. Byrd sailed on his hazardous flight to the South Pole his vessel was completely outfitted with Plymouth rope, including the tarred hemp bolt product for the sailmaking equipment, as well as spun yarn, marline and hambroline used in outfitting the flagship and the supply ship, together with Manila hawsers and tow lines, Manila rope for ice anchors, halyards, and a variety of sizes of ropes for miscellaneous use during the two years' exploration.

Arthur T. Walden, of Wonalancet, N. H., in charge of the dog-team equipment, made a special trip to Plymouth, and selected the types of Plymouth rope to be used in harnessing the dogs into the sleds used in transporting the food and supplies for the expeditions to outpost stations.

In 1927 the Plymouth Cordage Company added 1,025 acres to its land holdings, in Cuba, bringing the total to 2,300 acres. Its plantation investment has fulfilled expectations and the entrance of other companies into the sisal field indicates that the Mexican monopoly of this raw material is being broken.

That year the company's total production of rope and twine was 104,-000,000 pounds.

The corporation has capital of \$8,000,000 and employs 2,000 operatives. Augustus P. Loring is president, B. Preston Clark, vice president, Francis C. Holmes, treasurer and general manager, and John D. Brewer, vice president.

OLIVER EDES—INVENTOR OF THE RIVET MACHINE

Oliver Edes, of Plymouth, at the age of twenty-two invented, fabricated and put into operation the first rivet machines which cut from drawn wire all the different sizes and forms of small rivets. The introduction of these devices revolutionized the rivet business, and from this beginning has grown the vast industry.

Prior to the time this native of Needham applied his genius to the problem all rivets had been made by hand and most of them were imported from Europe. Mr. Edes met with no little difficulty in marketing his product at the outset. He made his first attempt in Boston, where he encountered all sorts of objections, dealers being loath to believe that machine-made rivets could have any practical value. Not until he gave his rivets directly to the consumers for trial could he build up a demand for them from the trade.

In 1840 Mr. Edes formed a partnership with Andrew Holmes, for the manufacture of his products, at North Marshfield, where the business was carried on for three years, under the name of Holmes, Edes & Co. In 1843, the firm of Farris-Edes & Company was established, and a year later the concern removed to Plymouth.

Mr. Edes retired from the firm in 1850, and Mr. Farris and others, continued the production of rivets under the name of Plymouth Mills.

In 1850 Oliver Edes and Nathaniel Wood, of Plymouth, formed the

firm of Edes & Wood, and began the manufacture of zinc shoe nails and tacks, in the village of Chiltonville, located in the southerly part of Plymouth. Here they installed a zinc rolling mill—one of the earliest set up in the United States. Nine years later, Mr. Edes purchased his partner's interest, and continued the business as sole proprietor, and in 1880, his son Edwin L. Edes became associated with him, and the firm of Oliver Edes & Son, was formed. Upon the death of the father on February 21, 1884, the son continued the business under the name of Edwin L. Edes, until 1893, when the Edes Manufacturing Company was formed, with Edwin L. Edes as president, and Edward W. Belcher, as clerk and treasurer. The previous year, Edwin L. Edes sold the plant and water-power, in Chiltonville, to the late Eben D. Jordan, of Boston, at that time the head of the Jordan-Marsh Company and the property is now the summer home of the distinguished Boston attorney, Sherman L. Whipple. The business was then moved to a site adjacent to the Plymouth depot of the N. Y., N. H. & H. R. R., Company where the line of production was enlarged to include battery zincs and zinc plates for electric batteries, lamps, and art bronze commodities.

During a raging snow storm on the afternoon of February 12, 1897, the plant was completely destroyed by fire, but was immediately rebuilt. In February 1901, the office of vice president was created and Alton D. Edes the eldest son of Edwin L. Edes, was elected to that position, which he has since filled. In February, 1907, Oliver L. Edes, second son of Edwin L. Edes, became a director of the corporation, and in September, 1913 when Mr. Belcher retired, Oliver L. Edes was chosen clerk and treasurer. Many additions have been made to the new plant, the most extensive of which was erected in 1927.

The Edes Manufacturing Company stands as another conspicuous example of a Massachusetts concern adapting itself to the changing demands of commerce. It early became a pioneer in producing zinc plates for the photo-engraving trade, and gradually the manufacture of lamps and art bronze goods was succeeded by zinc plate production until today the concern has become one of the leading manufacturers of this type of commodity, although it still produces battery zincs.

The corporation employs about one hundred and fifty operatives.

Oliver Edes was a native of East Needham, where he was born on November 10, 1815, and his son, Edwin L., was born at Plymouth, January 5, 1853, and had three sons—Alton D., Oliver L., and Chester R., the latter dying some years ago. Edwin L. Edes died in September, 1929, and the business is now carried on by his sons.

On April 15, 1828, Elisha H. Collier, of Plymouth, was granted a patent covering a process for manufacturing paper from sea grass.

THE RIPLEY & BARTLETT COMPANY

In 1879, Edward T. Ripley and George D. Bartlett leased a small area in a local mill, and formed the partnership of Ripley & Bartlett, engaging in the manufacture of shoe tacks. Soon outgrowing the quarters they purchased about 1882 or 1883 the present factory site, opposite the station of the New York, New Haven & Hartford Railroad Company, and in 1913 the junior partner withdrew, at which time the business was incorporated at The Ripley & Bartlett Company with Edward T. Ripley as

president and Herbert W. Clark, as treasurer. Upon the death of President Ripley in 1923, Elizabeth M. Ripley was chosen to succeed him.

New lines of production were added, when the concern erected its factory, and at present tacks for upholsterers, bill posters, shoes, and the hardware trade are produced by fifty employees, the production being marketed throughout this country and in many markets abroad. The corporation has capital of \$35,000.

MAKING A POUND OF WIRE EXTEND MORE THAN SIXTY MILES

The firm of Bradford, Kyle & Company was organized in 1890, succeeding other units, and continuing the business of manufacturing insulated electrical wires.

Its line was at first limited to the finer sizes, but today it includes a wide range, from wires required in winding power machines to diameters necessary for the most delicate instruments of precision for electrical testing.

It was the first concern in the world to produce wire finer than number forty American gauge, viz, 0.0031". When an internationally known inventor required copper wire of 0.002" diameter he was told by manufacturers here and abroad, that it was a mechanical impossibility to produce it. After much experimenting, and the development of a machine for the purpose, Bradford, Kyle & Company succeeded in manufacturing wire of that diameter, and soon after the concern reduced it to 0.0015". This made possible the perfection of electrical instruments of the utmost sensitivity, and also apparatus that immeasurably aided developments in the field of wireless communication, and in the later discoveries and expansion in the sphere of the radio.

The concern is now covering an alloy wire of 0.001" diameter, a single pound of which would extend more than sixty miles!

Copper, aluminum, and a variety of resistance wires enter into the regular line, and silk, cotton and enamel are the insulating materials mainly used.

Honorable William S. Kyle is the owner of the concern, which employs thirty-five operatives.

GEORGE MABBETT & SONS COMPANY

The investigator of industrial conditions in Massachusetts would scarcely look to the town made famous as the landing place of the Pilgrims for one of the most outstanding developments in textiles, yet there was established in Plymouth, at the very dawn of the present century a concern, whose founders determined it would manufacture only the finest grade of fabrics for men's wear, and which in a little more than a quarter of a century has built up a reputation among the leading merchant tailors of this country as the producer of clothing that is preferred by the discriminating trade over the highest quality of imported fabrics. Such is the record of George Mabbett & Sons Company, established in 1900 and incorporated two years later, and manufacturing at the outset only fifteen hundred yards of fine goods each week.

In less than three decades production facilities have been extended until today between 15,000 and 16,000 yards of woolen suitings are woven on the company's looms each week, and in 1928 the Aberthaw Company

of Boston erected a large addition to the Plymouth plant which will enable the enterprise to increase its output materially.

The Mabbett products are handled at the New York City office of the concern, located at 200 Fifth Avenue, and are sold to the leading jobbers and the fine clothing manufacturers of the United States.

The corporation has capital of \$440,000 and employs upwards of 350 operatives.

George E. Mabbett is president, H. S. Avery, secretary and treasurer, and Henry Walton, superintendent.

THE STANDISH WORSTED COMPANY

In 1900 the Standish Worsted Company was incorporated and is engaged in the manufacture of men's worsted wear, operating eighty looms, and complete dyeing and finishing departments, at its Plymouth plant, where upwards of 500 operatives are employed.

E. H. Dorr is president and Albert L. Mellor, secretary and treasurer, and the concern operates an auxiliary plant, at Penacook, N. H., and has its New York City selling headquarters, at 200 Fifth Avenue. The corporation has capital of \$1,000,000.

The Puritan Mills, of the American Woolen Company, equipped with 254 looms, and dyeing and finishing departments, manufacture men's wear, at the Plymouth plant, of which Otis P. Wood is agent.

The Plymouth Foundry Company employs seventy-five operatives in the manufacture of stoves and castings, the corporation having capital of \$50,000. L. J. Grinnell is president and Bernard Field, secretary and treasurer of the corporation.

The Boston Woven Hose & Rubber Company, of Cambridge, has an auxiliary factory in Plymouth, where reclaimed rubber is treated, and manufactured into mechanical rubber products.

W. S. Gale is the owner of the Plymouth Bottling Works, which concern manufactures beverages.

The Plymouth Electric Light Company has capital of \$750,000. A. C. Bent is president, George H. Williams and Bowen Tufts, vice president, and Sarah C. Bodell, secretary and treasurer.

PLYMPTON AND ROCHESTER

The Plympton Mills, Inc., of Plympton, were incorporated in 1917, with \$30,000 capital and manufacture shoe sewing threads. Roy L. Keith is president and treasurer of the concern.

In the first quarter of the nineteenth century, Rochester had a cotton factory, established in 1812, another formed in 1816, a paper mill, which began business in 1824, and a manufacturer of hollow ware, that was started the following year.

Today, its manufacturing operations are confined to two lumber mills—the Hartley Saw Mill Company owned by D. E. James, H. B., H. E. and G. Hartley, and also operating in Marion; and Rounseville Brothers, a partnership which includes Arthur, Albert and Ralph L. Rounseville, with headquarters in Mattapoisett.

ROCKLAND HAS BEEN A SHOE TOWN FOR 100 YEARS

Rockland, known in earlier days as East Abington, is one of the pioneer shoe towns of Massachusetts and as early as 1837 almost 1,500

workers were employed in the local factories of this industry. Shoe products to the value of \$944,715 were manufactured there that year, and 200,175 pairs of boots and 470,120 pairs of shoes, were turned out.

In the early days of the nineteenth century all the local production was carried on by hand but the march of machinery swept away the modest little shoemakers' shops, and instead of the work coming to the worker, the worker went to his work in the factories which grew up as machines superseded the individual production.

In 1880 there were twenty-six local factories, and it is interesting to note what the installation of shoe machinery had accomplished in the forty-three years succeeding 1837. Products to the value of \$1,163,300, or more than \$200,000 more than the value of the 1837 output, were manufactured in 1880 by 731 employees, whereas in the former year it required the employment of 1,581 workers to produce boots and shoes having a value of \$944,715. The twenty-six establishments in 1880 had invested capital of \$153,600 and used stock and materials valued at \$721,450. Three years later 30,000 cases of shoes were shipped out of Rockland in a twelve months period.

John Spence was the first local manufacturer to inaugurate the production of heels as a separate and distinct industry, and began business in the town in 1854.

THE HURLEY SHOE COMPANY

In 1852, Patrick Hurley, then a youth ten years of age, landed in America, and was fortunate in being taken into the home of one of the foremost families residing in Halifax, where he was treated as a son.

Like most of the boys of that period he attended school, and worked after hours and on Saturdays pegging shoes. At the age of eighteen he joined the State Guard and when the war broke out, answered the first call and went to the front. His first destination was Fortress Monroe, and his first duty was to scuttle some vessels in the harbor in order that they might not be taken by the Confederates. Among them was the *Merrimac* which was raised by the enemy and covered with an iron-clad roof, the ship playing havoc with Federal commerce until it met its Waterloo in that memorable battle with John Ericsson's *Monitor*.

Returning to Rockland at the expiration of three months' service, where a brother resided, Mr. Hurley joined with several other young men at the old Congregational church in ringing the bell to call the boys together; and that night he and many of them enlisted in the 43rd Massachusetts Regiment made up mostly of boys from Rockland, and the surrounding district. He served out his enlistment and then went to the front a third time, in the Third Maryland Regiment.

When Mr. Hurley returned to Rockland after the war, he found that the Congregational church had been made over into a shoe factory. Here he was employed and several years later two of his sons, J. J., and W. M. Hurley learned their trade as shoemakers, in the employ of the late Senator E. T. Harvell. Later this factory burned and a new plant was built for the Rockland Company.

The Hurley brothers and their father succeeded the Rockland Company and began making high grade shoes under the name of the Hurley Shoe Company. The company was successful from the start and the father and four sons built up an honorable reputation. In 1918 Patrick

Hurley answered the "last call" his death removing from the district the last surviving Minute Man of '61. Because of the esteem in which he was held by his comrades of Co. G, 43rd Massachusetts Regiment, his four sons, at the next meeting following his death, were elected honorary members of that organization.

The present officers of the Hurley Shoe Company are: John J. Hurley, president; William M. Hurley, treasurer; Edward F. Hurley, clerk; and these together with George A. Hurley complete the board of directors. *Affiliated with the Hurley Shoe Company are the Hurley Shoe Stores Company, of Boston and New York, of which Mr. W. B. Kingman is vice president and general manager.*

The company manufactures the Gripsem arch shoe for women, which contains a patented feature attached to the innersole. The corporation has capital of \$350,000 and employs 300 operatives.

THE STORY OF ALDEN, WALKER & WILDE, INC.

In 1889, Arthur H. Alden, George A. Walker, William H. Wilde, and Fred L. Alden began the manufacture of shoes in Middleboro, under the name of Alden, Walker & Wilde, but five years later when the factory was destroyed by fire, the partners purchased the stock and equipment of Torrey, Curtis & Tirrell, of North Weymouth, a firm that was retiring from business, and in 1904, when this plant was outgrown, they bought the factory formerly occupied by M. C. Dizer & Co., at East Weymouth.

In 1912 Arthur H. Alden retired and in 1919 William H. Wilde and Fred L. Alden withdrew and disposed of their interests to Alfred L. Lincoln and Horace R. Drinkwater, president and treasurer respectively, of the Edwin Clapp & Son Company, of East Weymouth.

The firm was then incorporated and became known as Alden, Walker & Wilde, Inc., with Mr. Lincoln as president, George A. Walker as vice president, and Mr. Drinkwater as treasurer.

In 1920 Mr. Drinkwater retired. Seven years later it was decided to discontinue the manufacture of a general line of shoes and to specialize on the production of a feature shoe, the company having made a contract, in 1924, with Oliver E. DeRidder of Rochester, N. Y., the inventor of the DeRidder patent for moulding an innersole on the last and the E. P. Reed Company of Rochester, N. Y., makers of the MATRIX shoes for women, giving Alden, Walker & Wilde, Inc., the exclusive right to manufacture MATRIX shoes for men. At this time Harry T. Wright became associated with the concern as vice president and general manager. The present officers are: president and treasurer, Alfred L. Lincoln; vice president, Harry T. Wright; secretary, Frank W. McKeen. The corporation has capital of \$250,000 and employs 250 operatives.

Rockland is the home of the widely advertised Emerson Shoe manufactured by the Emerson Shoe Manufacturing Company of which Charles Brandman is president, and Edward Friedman is treasurer. Three hundred operatives are employed at the local plant of the company.

The largest local shoe-producing concern is E. T. Wright & Co., Inc., which has capital of \$1,370,900 and which employs upwards of 700 operatives in the manufacture of shoes.

Alfred W. Donovan is president, John G. Owens, secretary, and Hon. Elwin T. Wright, a former member of the Governor's Council, is treas-

urer. They with Charles I. Wright, James A. Munroe and Alfred F. Donovan constitute the board of directors.

The Murphy & Osborne Shoe Company, Inc., with capital of \$50,000 employs sixty operatives and specializes in the production of boys' shoes. James W. Murphy is president, C. N. Osborne, vice president, and John W. Higgins, treasurer, of the corporation.

In 1927, Schwarz, Ruggles, Inc., removed its shoe manufacturing business from Brockton to the then idle plant formerly occupied by the J. E. French Company, and employs 125 operatives in the manufacture of shoes. Bruno E. Schwarz is president and treasurer, M. E. Hayward, vice president, and E. S. Ruggles, secretary, of the corporation.

The Rockland Webbing Company was incorporated in 1902, and has capital of \$100,000. It is engaged in the manufacture of cotton, silk and mercerized elastic and non-elastic narrow fabrics, and the plant is equipped with 100 braiders, ninety-two looms, three boilers, and 150 operatives are employed in the Rockland and North Abington factories of the company. E. C. Woodward is president, and C. A. Woodward, treasurer and secretary of the corporation.

The H. H. Arnold Company, Inc., has capital of \$25,000 and manufactures shoe machinery, parts, reamers, and rubber covering machines. H. H. Arnold is president, F. A. Arnold, clerk, and H. P. Arnold, treasurer.

The Packard Carton Company of Brockton operates a branch factory at Rockland, in the production of paper boxes, 125 operatives being employed in the two units. The corporation has capital of \$100,000. C. L. Packard is president and treasurer and Frank E. Packard, secretary.

The Rockland Welting Company, owned by John P. Spence and the estate of John W. Spence, employs seventy-five operatives in the manufacture of leather shoe supplies.

The Rockland Standard Publishing Company owned by Frank S. Alger is engaged in publishing and printing.

In 1929 Harry T. Wright & Co., Inc., was formed to manufacture leather and rubber products.

The E. Bottomley Company has capital of \$50,000 and employs 100 operatives in the manufacture of women's McKay shoes. M. Goodman is president and David Braude, treasurer.

The Condon Cut Sole Company, of which Patrick Condon is president, secretary and treasurer, manufactures men's and women's cut soles.

The Lane Manufacturing Company, owned by C. K. Lane, manufactures elastic products, bathing belts, athletic supporters, etc.

The Rockland Fire Works Co., Inc., has capital of \$50,000 and produces fireworks. Alexander Mariani is president and treasurer.

The Whitmore-Tirrell Shoe Corporation has capital of \$100,000 and manufactures children's and misses' shoes. Walter J. O'Hara is president, Guy C. Fletcher, vice president and general manager, and Edward K. Whitmore, treasurer.

SCITUATE

Robert Studson, Mr. Hatherly, the father of the town of Scituate, and Joseph Tilden, built a sawmill in that village, in 1656, which it was said "may be the first in the Colony."

The permission granted on November 10th to erect this plant was to be void unless it was built in three months from the date of the grant. It

was erected on "the third Herring Brook," and was destroyed by the Indians in 1676.

The King's Commissioners, who visited New England in 1664, reported the old Colony of Plymouth as having "about twelve small towns, one saw-mill for boards, etc." It is believed this sawmill was in Pembroke, then a part of Duxbury.

In 1668, there was enacted a law reserving for public use all white pine trees measuring 24 inches in diameter at three feet from the ground. This prohibition, and those of the British Parliament in the reign of William III and Queen Anne for the preservation of white pine timber for masting for the Royal Navy in these and other Provinces, probably interfered to some extent with the manufacture of lumber from the larger trees. A compensation, however, was found in the encouragement given at the same time for the exportation and manufacture of masts and naval stores by bounties, some of which were continued until after the Revolution.

In 1702 an iron furnace was built in Scituate.

The Boston Sand & Gravel Company operates one of its plants in the town, but the municipality possesses no other manufacturing enterprises today.

WAREHAM'S OLD AND NEW INDUSTRIES

The manufacture of hollow ware began at Wareham, in 1805, when the first blast furnace built there was taken over for that purpose. In 1812 the first cotton factory established in the town was erected, and later several other units engaged in this type of manufacture.

About 1817, Messrs. Howland and Tobey erected a mill on the Weweantit River in South Wareham, where roll nail plates and cut nails were manufactured. The year 1819 is memorable in the industrial history of this Cape Cod town, as it marks the beginning of the modern organization of the cut-nail industry, which has made the municipality famous.

It was at that time that the little plant was established, from which the Tremont Nail Company has grown, and it was then that the struggling and scattered units of nailmaking handicraft began to realize the necessity for leadership, coöperation and union, if the industry was to survive and their pioneer investments, were to be safeguarded.

Thus for considerably more than a hundred years the cutting of nails has contributed the chief industrial activity there, the first production of the commodity by machinery being carried on in 1822 by the firm of Isaac and Jared Pratt & Co. which erected a rolling mill, that year. Simultaneous with this enterprise Bartlett, Murdock & Co. erected the Washington Iron Works, which, in 1845, were purchased by the Taunton Iron Works, and in 1824 a paper mill was built in the town and was operated for many years thereafter.

In 1827 nail works were established at South Wareham, being taken over a few years later by the Wareham Nail Company and in 1836 the Agawam Nail Company began business in Wareham.

In 1828-29 the Tihonet Works, were established, and one of the largest and most completely equipped rolling mills in the country was set up by the concern, a puddling machine being installed for melting iron, while 50 nailing machines were included in the equipment.

The Wareham Iron Company operated in the town until 1834. In 1845 the Parker Mills Company was incorporated, and purchased the Tihonet

Works which were conducted by the new concern for three years until the plant was burned. A new factory was immediately rebuilt and was operated until 1878. Three years later the Bridgewater Iron Company purchased the property.

The original Parker Mills had been engaged in nail manufacture in a coöperative way since 1819 in a building standing on the bank of the Wankinco River, which had originally been erected in 1796 by Benjamin Fearing, who used it as a fulling mill.

While there may be some question whether the original fulling mill, a transformed and reconstructed plant or an entirely new structure was the home of the coöperative effort, there is no doubt that the advent of the original Parker Mills group came about in 1819, that the site was identical with that occupied by the Parker Mills Company of later years, and that the seedling planted then and there has survived the storm and stress of the years and grown into the sturdy and vigorous Tremont Nail Company.

Groups of families in neighborhoods formed themselves into coöperative bodies to pursue nail-making and children learned the art early to add their mite to the general welfare. The establishment of the Parker Mills in 1819 was the earliest effort to place nail-making in Wareham upon a business basis, and it became an enterprise of combined labor and capital with an up-to-date commercial organization. Ore was brought to Wareham by water and poled up the Wareham River, through the locks into the canal that brought it to the mill gates.

In 1845, the Tremont Iron Company was organized and engaged in the manufacture of nails, and three years later the factory now occupied by the Tremont Nail Company, which in 1858, purchased the assets of the old iron concern, was erected at the lower dam. It was at this plant that the Tremont Nail Co. achieved the reputation for skilful nail-cutting that has made its products readily saleable in the markets of the world.

Nahum Stetson was the agent and treasurer of the Parker Mills, which comprised two distinct units—a rolling mill, and a nail plant. The concern was incorporated with a capital of \$200,000, and Benjamin Rodman served as its first president. The corporation had an annual capacity of 100,000 kegs of nails, operated 85 machines, and employed, in 1855, about 225 hands. Approximately 6,000 tons of iron and a similar quantity of coal were used each year. The plant had two unfailing water privileges, with falls of 26 and 18 feet respectively, located on the Wankinco River, at Wareham center, on the site of a cotton mill taken by the British in the War of 1812, and easy of access both by water and by the Cape Cod Railroad.

In 1883, the Tremont Nail Company so changed its mechanical equipment as to enable it to utilize plates that were made by welding worn-out Bessemer steel rails, it being the first manufactory in the world to adopt this process, and was operated for many years thereafter.

The casual visitor to Cape Cod will find in the old homesteads there, cut nails made a hundred years ago, performing their function after a century of service, and maintaining perfectly the charming old houses in which they were driven, and this in spite of the trying climatic tests and salt gales that are perennial in that locality. No test could be more practical, no result more convincing—they have stood the tests of time.

The superiority of cut nails for all outside construction is incontestible. They have gained and maintained an undisputed reputation for durability,

holding power and clinching properties. They possess these qualities because they are cut from metal containing an exceeding small percentage of impurities, and this material is rust-resisting to a remarkable degree. The holding power is due to the shape of the nail, its rough surfaces and the fact that it is wedged rigidly into the fibre of the wood when driven.

The cut nail is superior to all other kinds for construction, where strength of head is concerned. For laying hardwood floors, clapboarding, shingling, slating, fence and piazza construction, and all outside finish, this factor is of paramount importance.

The Tremont Nail Company has capital of \$100,000, and employs upwards of 300 operatives not only in manufacturing cut nails, but in the production of steel, billets, and tack plates.

J. S. Kenyon is president and treasurer, W. H. Thomas, secretary, and J. M. Clavin, assistant treasurer.

The advent into Wareham of so many nail-producing concerns naturally gave rise to the formation of a stave mill, where, for many years, wooden casks were made.

THE STANDARD HORSE SHOE COMPANY

In 1872, Edgar Robinson organized the Wareham Nail Company, and purchased the property where fifty-five years before Messrs. Howland & Tobey had built their roll nail plate and cut-nail factory, on the Weweantit River, in South Wareham.

The Wareham Nail Company utilized scrap iron from foreign markets in producing nails, the sales covering the country and Valparaiso.

Edgar Robinson was a man of vision, and being imbued with an earnest desire to give to his country some leaders in industry, he originally schooled his son and his two step-sons, in the intricacies of nail manufacture, and then placed them in the Massachusetts Institute of Technology, from which the trio were graduated. One of the step-sons, Theodore W. Robinson, is now and has been for many years vice president of the Illinois Steel Company, of Chicago, one of the units of the United States Steel Corporation; another, C. Snelling Robinson, is vice president of the Youngstown Sheet & Tube Company of Youngstown, Ohio, one of the country's largest producers of steel, and the third, his own son, Dwight P. Robinson, is at the head of the United Engineers and Constructors, Inc., of Philadelphia, into which the internationally known firm of Dwight P. Robinson & Co. was merged. The latter firm built the new Boston & Maine Terminal Station, the Statler Hotel, at Boston, the Thompson Spa Building, and numerous other structures in Boston, while its ramifications in the constructive field have covered all the principal cities of the United States.

In 1890, the Standard Horse Shoe Company was incorporated with \$100,000 capital, and the plant of the Wareham Nail Company was purchased, new machinery installed, and the manufacture of horse and mule shoes begun, the present capacity being 100,000 kegs per year. The product is sold principally in New England, but it is an interesting commentary upon present-day manufacturing conditions that this progressive concern has found it possible to lay down horse shoes on the wharves of San Francisco that can be marketed profitably at a lesser price than the producers of similar articles, whose plants are located in the Middle West, can dispose of their goods in Pacific ports. This has been made

possible by the use of the Panama Canal, the water transportation rates being the determining factor.

During the World War, the Standard Horse Shoe Company was called upon to furnish a large quota of horse shoes for the various quartermaster depots, and a large tonnage was shipped to France. The concern employs about 100 men, maintains a Boston office, at 131 State Street, and is managed by Ronald M. Boutwell, president, and George S. Boutwell, secretary.

THE HAYDEN CRANBERRY SEPARATOR MANUFACTURING COMPANY.

The Hayden Cranberry Separator Manufacturing Company was established in 1895, to produce cranberry separators, blowers, elevators, and screen house equipment. Later the business was extended to include the manufacture of picking scoops, sanding wheelbarrows, and screens, bog and screen-house supplies, and the Urann sand spreader, as an attachment to a steel dump-body. E. C. St. Jacques is the sole owner and manager.

THE NEW BEDFORD AND AGAWAM FINISHING COMPANY

In 1909 the New Bedford & Agawam Finishing Co. was incorporated, and operates a plant at East Wareham, where the dyeing, finishing, bleaching and mercerizing of fine cotton and silk fabrics, and cotton piece goods is carried on, the plant having a capacity of 750,000 yards weekly. Three hundred operatives are employed, and the corporation has capital of \$235,000. It maintains an office at 320 Broadway, New York City. John W. Knowles is president, H. C. W. Mosher, treasurer, and K. L. Rice, superintendent.

THE CAPE COD SHIPBUILDING CORPORATION

The Cape Cod Shipbuilding Corporation carries on a diversified line of production, ranging from the small skiff to the luxurious motor-powered craft, at its extensive plant which includes eighteen buildings, located on an area of ten acres. The company's boat assembly shop is 200 feet in length, and the process of completing a vessel is not unlike that today in operation in the modern automobile plant.

The corporation maintains a permanent display of its products at 782 Commonwealth Avenue, Boston, an office at 18 Tremont Street, Boston, and export headquarters, at 25 Broadway, New York City.

The concern makes a specialty of standardized craft such as dory launches, runabouts, knockabouts, junior sail boats, outboard motor craft, decked sail boats, rowboats, aquaplanes, swimming floats, etc.

The company has capital of \$150,000 and employs sixty hands.

C. S. Gurney is president, Stuart McLeod, secretary, and William Minot, treasurer.

ATWOOD BROTHERS, INCORPORATED

When, in 1866, Benjamin S. Atwood, who had been a "Minute Man" in '61 and who had participated in the first offensives of the group which volunteered to save the Union, returned to Whitman, he began the manufacture of plain wooden shipping boxes in a small way, particularly designed for shoes. Next he added cleated end and lock-corner boxes of smaller type and fabricated from varying thicknesses of lumber, which

were used for all conceivable purposes. To add to their salability, he printed the customers' names and advertisements on the products, in one, two and three colors.

Mr. Atwood remained active in the business for fifty-seven years, and five years before his death, in April, 1923, the concern was incorporated, with capital of \$300,000 as Atwood Brothers, Inc.

Iron bound ginger ale and soda boxes and egg-cases, with the covers fitted with hinges and fasts, and shoe racks were added to the company's line, the latter being shipped all over this country, while the market of the company's boxes is largely confined to New York, Philadelphia and New England.

The company is housed in a brick factory containing more than 60,000 feet of floor space and in addition there are eighteen immense sheds for the storage of lumber. Its yards cover some 34 acres and it also has a spur track about one-quarter mile long, connecting with the N. Y., N. H. & H. R. R. In the busy season the concern employs about 200 men and turns out 22,000 to 25,000 boxes per day.

About one-half the lumber used is purchased and the remainder is manufactured in log mills belonging to the corporation, one at the Whitman plant, another in the southeastern part of the state and a third in Maine. The log machines have been so improved that a band saw making a 1/16" kerf is now used instead of the old circular saw with its inserted teeth which made a kerf 5/16" thick. This means that about twenty per cent of the log which formerly became sawdust is now made into lumber. The factory is completely equipped with the best of modern machinery, most of which is automatic.

The company operates lock-corner cutters, into which a handful of small pieces of lumber is placed at one end and clamped, and carried by the cutter, released and packed up at the other end. The operation of the company's setting-up machines is interesting. From two piles of ends and two piles of sides, pickers continually take out the bottom pieces, and they are carried along a track where glue is applied by compressed air, next dropped into a hopper which places them in proper position, drives them together and they emerge from the bottom of the machine completely assembled, at the rate of about 3,500 per hour. The printing press at the plant works on a similar principle, the pieces being filed at one end, the bottom section being picked out, carried by the printing plates, and picked up at the other end at the rate of approximately 4,200 pieces per hour.

All types of circular saws and band saws, boring, matching, slide-cover, and handhole machines, planers and molders are included in the plant equipment. Nail machines drive all sizes of nails from a half inch to two and a half inches in length, and from one nail to sixteen at one stroke.

A well-equipped machine shop, where all the repairing is carried on and where many of the special machines designed by the company are built, blacksmith, paint and carpenter shops, an eight-stall garage, a smoking room for employees and a small hospital for injured operatives, are included in the factory layout.

Winthrop F. Atwood is president, Mabel F. Hoyt, secretary, and M. H. Atwood, treasurer, of the company.

THE COMMONWEALTH SHOE AND LEATHER COMPANY

In less than half a century Charles H. Jones has seen his modest shoe manufacturing enterprise, established in 1881, under the name of Chas. H. Jones & Company grow into the \$2,500,000 corporation, known as the Commonwealth Shoe & Leather Company employing 1,200 hands in its plants, at Whitman, and Gardiner, Maine. Since 1884 when the original company was merged in the Commonwealth concern, Mr. Jones has continuously served as its president and it is doubtful whether in all Massachusetts there is any other footwear producing concern that has been managed for so many years by a single head.

During all this long period he has witnessed the shoe and leather industries pass through many vicissitudes and all of their branches extend to greater proportions, but he has never wavered in his belief that Massachusetts is just as desirable a place in which to conduct manufacturing operations as any other state in the Union. Nor has age withered his activities or viewpoint. Alert to the power exerted by the printed word, the Commonwealth Shoe & Leather Company under his management, ranks as one of the most consistent national advertisers in the footwear field.

Charles H. Jones is president and Paul Jones, treasurer of the corporation.

THE REGAL SHOE COMPANY

One of the most famous of Massachusetts' many advertised brands of high-grade shoes may be said to have been built upon a railroad wreck.

While traveling in the interest of the well-known Boston wholesale dry goods house of Brown, Durell & Company, as one of its high-powered salesmen, Elmer Jared Bliss, a native of Wrentham, was seriously injured in a railroad disaster and the net amount awarded him, namely, \$1,500, gave him an opportunity to make a modest start in the manufacture of shoes, and led him to form the Regal Shoe Company, as well as to inaugurate a new plan for merchandising footwear, the details of which he carefully thought out in his mind during the period of his convalescence.

From that \$1,500 and an idea the corporation began business in 1893, with a single retail store, located on Summer Street, Boston. It was Mr. Bliss' firm conviction that the day had arrived in the evolution of the commercial development of the shoe manufacturing business to provide for the elimination of the middleman, or jobber, and that he must carry his goods direct to the consumer, without any intermediary.

His Summer Street store was the first step in proof of this belief. He also held that volume production and the employment of the most advanced methods of transportation then in vogue must be joined with direct retail distribution if shoe manufacturers were to survive.

The record of the Regal Shoe Company in the nearly forty years that have passed since its formation shows beyond cavil that Mr. Bliss is another of those far-seeing industrial executives produced by the Bay State who is not irrevocably wedded to the methods employed by the founders of American shoe manufacture.

The corporation has capital of \$5,000,000 and employs upwards of 1,000 operatives at its Whitman plant. Elmer J. Bliss is president, Charles H. Cross, secretary, Cyrus Monroe, treasurer, and George W. Robbins,

assistant treasurer of this internationally famous producer of Regal shoes. The company's Boston headquarters are at 125 Summer Street.

D. B. GURNEY COMPANY, INCORPORATED

It is a far cry from the primitive factory, where D. B. Gurney first manufactured tacks, by hand, in 1825, and carried the products on his back from Abington (now Whitman) to Providence, Rhode Island, where he boarded a steamer to New York, for the purpose of selling them, to the present up-to-the-minute plant of the D. B. Gurney Company, Incorporated, which has an output of 250 tons of tacks and nails each month, and now ranks as one of the largest concerns of its kind in the United States, being capitalized at \$240,000 and employing 150 hands. Throughout its more than a century of existence it has been conducted by three generations of the Gurney family, and is still owned and managed by the descendants of the founder. Specializing in tacks and nails for the shoe industry, to be driven by machines, it manufactures every kind of tack or nail made from tack plate.

William H. Dunbar is president, Alfred L. Fish, secretary, and A. H. Brigham, treasurer.

THE G. G. ROBERTS CORPORATION

In 1904, Benjamin Hobart, a grandson of the original Benjamin Hobart, who about 1807 bought the Blanchard patent, and was the first to manufacture tacks by machinery, founded the corporation, which bore his name for seven years. In 1911, when Mr. Hobart retired, his holdings were bought by G. G. Roberts, who organized the G. G. Roberts Corporation, which today operates and owns the brick factory, in Whitman, built by the firm of Dunbar, Hobart & Whidden, successors to B. Hobart & Son, of South Abington, now a part of Whitman. Mr. Roberts was employed by Dunbar, Hobart & Co., successors of Dunbar, Hobart & Whidden, until 1890 when the former concern was absorbed by the Atlas Tack Corporation, and he has been actively engaged in the tack industry since 1878.

The plant receives its power from the 250-horse-power Corliss engine installed in 1865, and the company manufactures all types of tacks from sheet metal. George G. Roberts, Jr., is president, D. F. Murphy, secretary, and George G. Roberts, Sr., treasurer of the corporation, which has capital of \$50,000 and employs thirty-five operatives.

THE BOSTON ELECTRIC HEATING CORPORATION

On January 9, 1924, the Boston Electric Heating Corporation was incorporated, with capital of \$10,000 and purchased the electric heating department of the Boston Last Company which it immediately moved to Whitman, where 3,000 square feet of area are occupied in manufacturing special electric heating apparatus for use in shoe plants, including treeing, lasting and turning irons, tool heaters, special stoves and ovens, glue and wax pots, sole driers, box toe softeners, steamers and backing presses. Special electric heaters are also produced for other purposes.

Charles E. Lowell is president, Donald B. Heath, vice president and Harold L. Spooner, treasurer and secretary.

The McLane Brothers Leather Company capitalized for \$65,000 employs twenty-five operatives in its local tannery. C. S. Reed is president and treasurer, W. H. Cody, vice president, and W. F. Kenealy, secretary.

The Metropolitan Shoe Company employs 100 operatives in the production of shoes, and has capital of \$60,000. Philip S. Aronson is president, Mark Aronson, vice president, and Mark Epstein, treasurer. The company maintains a Boston office at 42 Lincoln Street.

The United Shank & Fittings Company of 423 West Broadway, South Boston, operates a plant, in Whitman, where it produces shoe shanks, and where 110 operatives are employed.

The Kingsbury Box & Printing Company of Northampton operates a branch plant in Whitman, and the National Foundry Company is engaged in producing iron castings there.

The Aseptic Service Company, with capital of \$50,000, and whose main headquarters are at 161 Summer Street, Boston, manufactures toilet coin locks and pay toilet service commodities at its plant in Whitman. Benjamin E. Morse is president, A. N. Hunt, secretary, and Edward G. Brown, treasurer.

CHAPTER L

THE MANUFACTURES OF BOSTON—HUB OF THE UNIVERSE AND METROPOLIS OF NEW ENGLAND

Boston is not only the chief city of New England, but it is one of the four leading municipalities of the United States. It ranks with New York, Chicago, and Philadelphia as a centre of population and wealth. Great in itself, due to the presence within its borders of many of the largest manufacturing corporations that have been born in this country during the first quarter of the twentieth century, and with thousands of others of greater age, and possessing a Metropolitan Boston population of upwards of one and three quarters millions of people, it is also the second most densely populated area in the nation. Using the trading terrain, within a 50-mile radius of each of the "Big Four" cities of the United States for the purpose of comparison, the figures of the last Federal census show the rank to be as follows: New York, first, with 8,034,349; Boston, second, with 3,934,011; Chicago, third, with 3,615,101, and Philadelphia, fourth, with 3,611,626.

And it must be remembered, too, that these four million people residing in the Boston district rank high in average wealth, as Massachusetts shows a larger per capita savings deposit account than any other state in the Union. Metropolitan Boston, created by legislative enactment, has an area of forty square miles, and a population of 1,808,845 being surpassed in the United States, in density of population, only by New York City.

Three hundred years ago environment and economic demand conspired to establish pioneer industries in Boston, for here at that period were the potential power resources, here the bulk of the settlers, here such of the industrial inventors as had come across the seas from the mother country at that period, while here existed in acute form the economic necessity for industrial production, in order that the colonists might be clothed, fed and housed.

A number of factors conspired to aid the early development of industries in what today is commonly known as Metropolitan Boston. There were undeveloped water powers that needed but little assistance to render them serviceable for that period; there were colonists who had worked at various industrial callings before they came over seas, and many of them were ingenious in applying the principles of mechanics to the primitive enterprises of that day; there were others who were commercially resourceful and who knew how to create markets for what was manufactured; there were those who were adept in developing shipping which in the early days of the colony consisted largely of bartering the fish caught along the Atlantic seaboard for commodities of nearby islands and overseas nations, and there was capital accumulated by naturally thrifty colonists who through rigid economy had been able to save for the proverbial rainy day.

OUR PECULIAR INHERITED CRAFTSMANSHIP

Three centuries have not dissipated, but rather have accentuated these factors, and many others have made their appearance decade after decade.

The Mystic, Charles, Neponset and Saugus rivers no longer constitute the principal sources of Boston's power supply. In their wake have come steam, produced from coal, hydro-electric energy and fuel oil. The genius and skill of Boston craftsmen, mechanics and inventors are still existent. For generation after generation, sons have succeeded fathers in the local skilled mechanical trades, until it has long been proverbial that there exists in Boston, and on the Atlantic seaboard, an inherited craftsmanship unlike that found anywhere else on the American continent, which still distinguishes its mechanical production and affords its manufacturers a world market along specific lines that neither the years nor developments by competitors located in other sections of the nation have disturbed. Nor has there been an impairment of the commercial resourcefulness of Boston merchants by the industrial and commercial developments of other parts of the United States, for today ninety-nine per cent of all the hides used in the leather and shoe factories of the nation are bought and sold within a narrow circle of mercantile houses of not more than a square mile in area in the heart of the commercial center of Boston, while the city is the seat of the wool market of the United States, despite the fact that less than one per cent of the wool produced in this country is raised in New England.

It was in 1785 that Boston inaugurated direct trade with the East Indies, and two years later with Russia. It was the Boston ship, the *Columbia*, that Capt. Robert Gray used in opening trade with the northwest coast of America—the first United States vessel to circumnavigate the globe.

As early as 1805 Boston began to export ice to Jamaica, and later to Cuba, to the ports in the southern states, and finally to Rio de Janeiro and Calcutta, a trade that held up well until after the Civil War.

In 1824 the first regular steamship line was established from Boston to other American ports, and in 1840 this port was selected as the western-world terminus of the Cunard Line—the first steamship corporation to connect Great Britain with the United States. The clipper ship era was followed by the period when practically all of the coastwise traffic was handled by schooners, which craft later gave way to steamers.

Since 1914 Boston has experienced a renaissance, due in a large measure to the operation of the Panama Canal, which opened vast new American markets to the manufactures of this city, and of Massachusetts, thus continuing the tradition of foreign trade in the Hub which has existed since the very beginnings of American industry, when, in the spirit of enterprise, Thomas Handasyd Perkins, N. P. Russell, Jonathan Phillips, Nathaniel Goddard, and other merchant princes of a past generation, sent their ships to every quarter of the globe.

THE ADVANTAGES OF THE PORT OF BOSTON

In its geographical position with relation to the great ports of the world, Boston is unexcelled. With 141 miles of waterfront, including a lineal frontage of more than forty miles of berthing space for ships, on a depth of upwards of thirty feet at low water, 200 miles nearer Europe

than New York, and 400 miles nearer than Philadelphia and Baltimore, her position makes it possible to effect a saving of from two to four days on round trips between here and the ports of the United Kingdom and of continental Europe.

Nearer to South American ports than any other city located on the Atlantic Ocean or the Gulf of Mexico, save Norfolk and Charleston, it has by reason of this position a direct advantage in the handling of Egyptian cotton, Mediterranean commodities, and jute, burlap, hides and skins from India.

Boston also enjoys a special advantage with relation to South American ports, south of Pernambuco, in the matter of imports of bananas, sugar, fruit, sisal, mineral oils, wool, hides, coffee, cocoa, rubber, and many other materials consumed in the manufacturing operations of New England.

Boston Harbor proper has an area of about forty-seven square miles exclusive of the islands, and the entrance from the outer bay is nearly four and three-quarters miles wide, the distance from that point to the Charleston navy yard, at the upper end of the harbor, being about seven and one-half miles. A thirty-five foot channel extends the entire length, and in the outer harbor three main channels lead from the sea to President Roads, the deep water anchorage.

The main ship channel of the inner harbor is 1,200 feet wide and 35 feet deep at mean low water, while the three main arteries of the outer harbor include Broad Sound South Channel, extending from Broad Sound to President Roads, 30 feet deep and 1,200 feet wide; Broad Sound North Channel, 35 feet deep and 1,500 feet wide, and the Narrows, leading from the southeast into Boston Harbor proper, 27 feet deep and 1,000 feet wide. In the inner harbor, Mystic River enters the northern end and possesses an improved channel varying from 500 to 900 feet in width, 30 feet deep, and extending for a distance of one and one-half miles, while Chelsea Creek Channel is a mile long, 25 feet deep, and 150 feet wide.

Today, the port of Boston has direct steamship connections with the principal ports of the world, including the following: East Africa—Beira; South Africa, Algoa Bay, Cape Town, Delagoa Bay and East Lodon; West Africa—Axim, Dakar, and Grand Bassam Secondee; North Africa, Algeria and Bona; in Asia, with Kobe, Moji, and Yokohama, in Japan; with Hankow, Hong Kong and Shanghai, in China; with Cebu, Iloilo and Manila, in the Philippines; with Adelaide, Auckland, Brisbane, Fremantle, Melbourne, Sydney, and Wellington, in Australia and New Zealand; with Ponta Delgada, in the Azores; with Copenhagen, Gothenburg, Malmo, Oslo, and Stockholm, on the Baltic; with Colombo, in Ceylon; with Batavia, Belawan, Cheribon, Penang, Samaring, Singapore, Somabaya, and Sabang, in the Dutch East Indies; with Aberdeen, Antwerp, Avonmouth, Bremen, Cherbourg, Cobh, Dundee, Dunkirk, Fowey, Glasgow, Hamburg, Havre, Hull, Leith, Liverpool, London, Londonderry, Manchester, Newcastle, Rotterdam, and Southampton, in Europe; with Bombay, Calcutta, Madras, and Rangoon, in India; with Alexandria, Beirut, Jaffa, Patras, Piraeus, and Salonica in the Levant; with Bona, Algiers, Genoa, Leghorn, Marseilles, Messina, Naples, Palermo, Trieste, and Valencia on the Mediterranean; with Bahia, Buenos Aires, Montevedio, Rio de Janeiro, Rosario and Santos on the East Coast of South America; with Callao and Valparaiso on the West Coast; with Banes, Cardenas, Havana, Manzanillo, Neu-

vitae, and Preston, in Cuba; with Cristobal, in the Canal Zone; with Port Antonio, and Port Morant in Jamaica; with Port Limon, in Costa Rica; with Puerto Barrios, in Guatemala; with San Juan, in Porto Rico; with Tampico, in Mexico and with Tela in Honduras.

Up to 1865 substantially all of the wharves and terminals were owned and operated by private companies, but today of the total water frontage, the Commonwealth of Massachusetts owns over 1,200 acres of land in and about the harbor, including a frontage of about 3,000 feet on the main ship channel, these holdings being valued at upwards of \$10,000,000.

The Army Supply Base, at South Boston, owned by the Federal Government, has a frontage of 5,451 feet, of which 4,151 feet are on the Reserve Channel, and 1,025 feet on the slip adjoining the U. S. Navy Dry Dock.

The Boston & Maine R. R. Co., is the next largest owner, occupying practically all of the deep water-front of the Charlestown peninsula, with the exception of the U. S. Navy Yard. The latter fronts on deep water at the confluence of the Charles and Mystic rivers.

The Boston & Albany R. R. Co., has five piers in East Boston, connected with the mainland by the Grand Junction Railroad, which operates through East Boston, Chelsea, Everett, Somerville, Cambridge, and Allston.

The remainder of the Port water-front is owned by various coastwise steamship companies, or by private dock warehouses and pier corporations.

THE RAILROAD FACILITIES OF THE PORT

There are three physically distinct Ports within the confines of Boston Harbor, each served by an important railroad system.

The freight terminals of the Boston & Maine Railroad are at the north of the Charles River, in Charlestown, East Somerville and Cambridge, the principal overseas terminals reached by this railroad being the Hoosac Tunnel docks and Mystic wharf each of which has five piers. An important part of the equipment of the Hoosac Tunnel docks is the huge grain elevator with a capacity of one million bushels. A grain elevator of four hundred and twenty thousand bushels capacity is located at Mystic wharf.

The five terminals of the Boston & Albany Railroad, at East Boston, cover an area of more than forty-three acres, include a freight yard capable of accommodating 435 cars, with a reserve yard within a mile and a half of the terminals, having a capacity of 800 cars, and afford direct communication with the Grand Junction Wharves and with Commonwealth Pier No. 1. Included in the equipment is a grain elevator with a capacity of one million bushels. By reason of the facilities at these piers for loading grain, the freight and passenger lines occupying them are able to discharge passengers and general cargo, at the same time receiving grain for the outward voyages. All of the railroad's piers are connected with the grain elevator by conveyors, thus permitting four vessels to be loaded at a time.

The freight terminals of the New York, New Haven and Hartford Railroad are at South Boston, and afford direct service to and from its own piers to Commonwealth Pier No. 5 and to the Army Supply Base.

Interchange of freight between the various terminals is facilitated by

the operation of the Union Freight Railroad, with tracks on the waterfront streets of the city.

As the rails of all three railroads—the B. & A., N. Y. N. H. & H., and B. & M.,—extend directly to the side of ships, Boston has a great advantage over the costly lighterage and car floatage service employed at many of the other ports in this country.

There are six graving docks and one floating dock included in the port equipment, supplemented by eight marine railways.

The Boston Navy Yard Dock No. 3 is capable of docking the largest vessels in the world, having 1,204 feet, a bottom width of 115 feet, and a depth at the sill at mean high-water of forty-three feet and ten inches. Originally erected by the Commonwealth, it was sold to the Federal Government in July, 1919, with a parcel of land adjoining it, for \$4,158,385. Here the *Leviathan* and *Majestic*, two of the largest vessels in the world, are frequently docked, there being no other facilities in the western hemisphere that will accommodate these ships. Commonwealth Pier No. 1 serves as a terminal for both freight and passenger business, and is 840 feet in length.

Commonwealth Pier No. 5 was completed in 1913, at a cost of \$4,500,000, has a frontage of 400 feet on the main ship channel, with two slips, each 200 feet long with forty feet of water throughout their length, and affords berthing space for five or more ocean steamships.

The main two-story steel and cement structure is 1,167 feet long, and 360 feet wide, and is designed for both freight and passenger traffic, containing customs, examination rooms, waiting rooms, and other conveniences, and is equipped with depressed railroad tracks, with others extending along the entire length of the cap of the pier, thus permitting direct transfer of cargoes between steamers and railroad cars.

It has a remarkable record for the efficient and economical handling of cargoes, and has been largely instrumental in developing the inter-coastal business via the Panama Canal between New England and the Pacific Coast. It is equipped with nine large freight and passenger elevators and twenty-four electric winches.

This pier is located in the heart of Boston's wool district, the greatest wool market in the world, and is served by the New York, New Haven & Hartford Railroad.

THE ARMY SUPPLY BASE AND THE FISH PIER

The Army Supply Base, the largest in the United States, gives to Boston harbor modern facilities for loading and unloading forty-one large ocean-going ships at one time. A large part of the terminal has been released by the Government for commercial purposes.

The pier shed provides nine hundred and fifty lineal feet of berthing space on either side and three hundred feet along its face, with a depth of thirty-five feet at mean low water. The pier shed embraces two buildings, each nine hundred and twenty-four feet long, one hundred feet wide and three stories high, with a total floor area of five hundred and eighty thousand square feet, or more than thirteen acres.

The storehouse, which adjoins the wharf and pier sheds, is one of the largest buildings of its kind in the world. It is built of reinforced concrete, is eight stories high, one hundred and twenty-six feet wide, and one thousand six hundred and thirty-eight feet long, and has a total floor

area of over one million six hundred and fifty thousand square feet, or nearly forty acres. Its equipment includes forty-five electric freight elevators, six electric passenger elevators, four steam portable bridge cranes, having a capacity of $2\frac{1}{2}$ tons each, two 15-ton, one 18-ton, and one 40-ton steam locomotive cranes, 18 electric storage battery tractors each capable of hauling eight loaded trailers; 750 trailers, each having a capacity of about two tons; 130 trailers of various capacities; six electric vertical tiering machines and five pilers for stacking material in bags. The equipment also includes electrically driven single drum portable winches for use in connection with cargo hoists, with a capacity of 2,500 pounds each and a speed of 225 feet per minute.

Boston's leading position as a great fish market is due in no small measure to the fact that it has at its disposal the finest fish pier in the world in point of adaptability and service. Erected by the Commonwealth at a cost of \$3,500,000, exclusively for the fish business, it provides docking berth for forty vessels, while over eighty may unload simultaneously.

In 1926 more than 250,000,000 pounds of fish, valued at approximately \$8,000,000 were handled at the pier.

Within a stone's throw of these great South Boston terminals is the largest wool storage warehouse in the world, with a capacity of 100,000,000 pounds. But a few years ago and easily within the memory of middle-aged citizens of Boston, the area upon which these terminals are located was waste land and largely tidal flats.

No harbor dues are exacted in the Port of Boston, and on overseas freight, where the railroads obtain a rail haul, wharfage is provided free, with the result that vast quantities of exports from western points, and imports destined for the interior are handled here. Local shipments pay moderate wharfage charges. Vessels are permitted to enter Boston Harbor and anchor at quarantine at any time, and they may clear between 9 A. M. and 4 P. M. except on Saturdays, when the hours are from 9 A. M. to 1 P. M.

Pilotage into Boston for vessels engaged in foreign trade, with few exceptions, is compulsory, but it is not required of vessels engaged in the coastwise trade.

The port is amply supplied with tugboat service. At the railroad piers package freight is handled by steam and electric hoists operating in conjunction with the ship's tackle. Freight is moved on the pier and in sheds by hand trucks. Piers equipped for loading grain have conveyors which carry the grain through galleries extending to the piers, themselves.

Boston is well equipped to care for the repair of vessels, the Bethlehem Shipbuilding Corporation having located a 10,000 ton floating dock at Jeffries Point, East Boston, at a cost of \$2,000,000, and it has recently acquired the old Atlantic Works where another floating dock constituted a part of the equipment of that plant.

The wharves along the city proper frontage are now largely occupied by towboat companies and coastwise lines operating steamers regularly to Portland, St. Johns, Yarmouth, Halifax, Charleston, Jacksonville, New York and Maine ports. Long Wharf is the principal New England distributing plant of the United Fruit Company.

Many of these wharves have spur tracks from the Union Freight Railway.

Boston is the second United States port in volume of ocean borne pass-

enger traffic, being surpassed only by New York and the port has an enviable record for efficiently executing quarantine and other government health regulations governing overseas passenger traffic.

Many of the great liners now entering the port of Boston daily have a capacity equivalent to a fleet of thirty or more of the largest and fleetest of the old clipper ships.

THE RECENT GROWTH OF THE PORT

A noticeable development of recent years in the port activities is the expansion of the traffic of outlying portions of Boston Harbor. The steam power generating plant of the Edison Electric Illuminating Company of Boston, located on the Weymouth Fore River consumes more than six hundred thousand tons of coal annually. Similar great industries are responsible for increasing the commerce of Mystic River, and Chelsea Creek. A \$2,000,000 development is represented in the Wiggins Terminals Inc., the largest lumber terminal on the Atlantic seacoast, located on the Charlestown side of the Mystic River with facilities for discharging three or more steamers at one time. It is equipped with most modern handling devices which enable vessels to be discharged with great rapidity, the lumber being moved from the steamers by electric carriers and placed directly in cars or sorted into piles.

The officials of the Ford Motor Company realized the value of Boston as a port and built a plant on the shores of the Mystic River, in Somerville, where there is ample water to accommodate vessels.

The Mystic Iron Works is another important development.

While the total business of the port of Boston, according to official figures of the War Department, averaged less than nine million short tons per year during the years 1905 to 1921 inclusive, it increased to about fifteen million tons in 1922, 1923, and 1924. Notwithstanding this heavy increase in the total volume of the port's business, the appearance of the harbor, owing to the change from sail to steam and the enlarged capacity of present day vessels, is greatly changed from what it was in former years when the tonnage was much less but the number of vessels handling it was greater.

Within recent years the Federal Government expended \$460,000 in dredging the Broad Sound North Channel to a depth of forty feet at low water.

As the average tide in Boston Harbor is about nine feet, this improvement affords a high water depth of forty-nine feet thus permitting the largest steamers to pass safely in and out of the harbor at any stage of the tide. This depth compares favorably with the famous Ambrose Channel in New York harbor which has a low water depth of but forty feet and with a tide of four feet has a maximum depth of only forty-four feet at high water. Both by gift of nature and by the hand of man, the port of Boston is well equipped and capable of handling many times its present volume of commerce with ease and despatch.

SOME INTERESTING STATISTICS

By whatever process one prepares his statistical information he cannot but be impressed with the fact that the port of Boston is not declining.

If he takes the period covering the fall months of 1928 and compares them with the corresponding months of 1910 he finds there was a greater

number of steamship sailings from Boston in the former period than in the latter.

If he compares the number of vessels departing from Boston in 1928 he finds they were sailing to a greater number of foreign ports than did the vessels that left this port in the corresponding months before the World War in 1917.

If his yardstick is the collection of figures prepared by the Statistical Bureau of the U. S. Shipping Board, which include the number of tons of cargo actually loaded and unloaded at specific American ports,—a measuring device which provides accurate scales for determining the business done at the different ports in so far as volume and weight of the commodities which pass over the piers are concerned—again he finds little evidence of decline.

Placing its commerce on the scales in this way it is found that Boston holds third rank among all the Atlantic ports, being exceeded only by New York and Philadelphia, the former port overshadowing all others with 67,452,016 tons in 1927, while Philadelphia had 15,072,921 that year, as against 13,926,453 for Boston, 13,221,111, for Norfolk, and 11,125,396, for Baltimore.

The difficulty is that our critics are inclined to emphasize over-much the foreign commerce alone in judging the condition of business at a given port. While the overseas trade is highly important in developing any port, it is not the statistical story of the cargoes to distant lands that alone concerns the fortunes of a seaport city. In evaluating the worth of a location upon the Atlantic to the industries and the people of municipalities served by it, it is well to study the volume of the domestic water-borne commerce, and it is quite significant that when this factor enters the equation Boston appears in third place among the Atlantic seaboard ports.

Of all the cities from which shipments were made or received along the Atlantic coast, in 1927, Boston held second place in coastwise traffic, according to the figures furnished the Shipping Board by the Army Board of Engineers for Rivers and Harbors. While the port of New York's coastwise traffic was more than 37,000,000 tons that year, Boston's reached 10,740,922 tons; Norfolk's 10,580,148; Philadelphia's, 8,826,048, and Baltimore's, 2,638,048.

While Boston's share in the inter-coastal trade—that modern movement of water-borne commerce flowing from the construction and operation of the Panama Canal—is not large, yet in 1927 it amounted to 668,082 tons, as against that from the port of New York of more than 4,000,000 tons; that of Baltimore of nearly 2,000,000 tons, and that of Philadelphia, which was nearly 1,750,000 tons.

In 1927, Boston was in fourth place among the Atlantic ports in the volume of foreign trade, the tonnage of which was 2,472,560, as against 4,462,434, for Philadelphia, and 6,374,607 tons for Baltimore.

Boston, however, advanced from twelfth position in 1927 to ninth in 1928 in foreign commerce tonnage of all types from all American ports, north, south, or west.

Any city which in a twelve months period transports over its piers nearly 14,000,000 tons, embracing a wide range of commodities, ranks as a great port.

In yet another particular it is difficult to reconcile the statements of

critics that Boston is effete and on the way down the toboggan slide, for, according to the official reports of the U. S. Post Office Department the gross receipts of the Boston postal district increased from \$16,139,232 during the fiscal year of 1926, to \$17,164,354, for the fiscal year of 1927, an advance of 6.35 per cent, and were exceeded throughout the United States by but eighteen of the largest post offices, two of which were Worcester and New Haven.

Boston's percentage of increase was greater that year than those of New York, Chicago, Philadelphia, Pittsburg, San Francisco, and many of the largest cities in the country.

The opening on May 10, 1928, of the first trans-Atlantic cable which had been directly established between Boston and Europe, recognized the Hub as a terminal for cables uniting the other side of the ocean equal to New York City,—the only other American municipality enjoying this direct service. This innovation has added much to Boston's prestige abroad and placed her banks and merchants upon an equal service footing with any other city in America in reaching all European points.

RECENT AVIATION DEVELOPMENTS

Developments occurring in 1928 and 1929 point to Boston's becoming the most important airport in America, far exceeding New York in international importance. The greatest impetus was given to the Boston movement by the official designation of the city as the eastern terminus of the Transcontinental Air Line, which meant that the Hub became the Atlantic Coast end of the U. S. Government's beaconed line that traverses the American continent.

New York City was entirely cut off by this decision inasmuch as the cross-country line goes to the west via Albany, and Boston was established as the eastern terminus of across-the-ocean flying ships, ship-to-shore and shore-to-shore planes.

The Hub is the fastest growing air center in all America, and with the continued development of facilities at the Boston airport progress will be even more marked in the future than it had been up to the middle of 1929.

Already a plan is well under way to give Boston the world's largest and best equipped airport by extending the present field to include Governor's Island, thus affording the city an immense expanse of air field, in addition to the best water facilities anywhere on either the Atlantic or Pacific Coasts.

The Colonial Air Transport has been so successful with its Boston-New York line that beginning in July, 1927, it placed in regular service a 20-passenger Keystone—Patrician monoplane, having a high speed of 151 miles an hour, a flying schedule which enables it to stay aloft for six hours, without refuelling; capacity to climb 17,400 feet at the rate of 1,450 feet a minute; 63 feet long and 88 feet wide, and equipped with three bright cyclone 525-horse-power motors. It is the largest passenger-carrying ship yet launched in America, and the Boston demand for flying brought it to that city.

The completion of the East Boston vehicular tunnel will give Boston the most accessible airport in the world.

There is now under way a plan to center the airplane manufacturing

industry in Boston because of the availability of skilled labor, and leading local investment houses are active in the movement.

In 1929, the Atlantic Marine Airways began operating seaplane passenger service out of Boston to Nantasket, Provincetown, Hyannis, New Bedford, Woods Hole, Nantucket and Martha's Vineyard, the initial equipment comprising eight six-passenger seaplanes, three of which are low-wing Fokker mono-seaplanes.

THE DIVERSITY OF INDUSTRIES

Not only is Boston the largest wool center in the world, receiving annually more than 50% of the raw wool imported into the United States, and the largest world center and market of the allied shoe and leather industries, but here also are centered the paper trade of this country; the coffee and tea industries and the fishing trade, the City of Boston being the most important fishing port in the western hemisphere, having the largest fish preserving and cold storage plant for fish in the world.

The city is one of the three great rubber manufacturing centers of America, one of the greatest clothing markets in the United States, and stands third in this country in the field of book publication.

Its diversified industries, upwards of 2,600 in number, have aggregate capital of nearly \$1,000,000,000 and annually manufacture upwards of \$1,250,000,000 worth of products.

The city stands fourth in America in the volume of bank clearings, the monthly average being in excess of two billions of dollars, while its postal district, the largest in area of any in the United States, handles upwards of 1,500,000,000 pieces of mail a year.

Boston was the first city in the country to establish a municipal airport, and it has the most advantageously located airplane landing field on the Atlantic Coast.

It is the trading center of one of the richest industrial areas in the world, having upwards of 25,000 retail stores.

A complete historical and philosophical summary of the industries of Boston would require many volumes. The information from which such a resume would be drawn is meagre indeed, and exists primarily in fugitive statements of writers who, unfortunately, gave little heed to industrial interests—one of the chief defects in all history.

INDUSTRIAL BOSTON OF TODAY

There has arisen a myth that a generation ago Boston had developed a breed of supermen who dominated the finances and industries of the nation in a Golden Age, and that today the degenerate descendants and successors of these geniuses, lacking in enterprise and intelligence, have been sitting on the curbing watching the procession of progress pass by until Boston itself is little more than a collection of out-of-date brownstone fronts and in the words of Kipling only "a withered beldame now, brooding on ancient fame."

As a matter of truth and history the real picture represents successful striving against economic handicaps that existed in no other section of the United States.

Bereft of natural resources, no navigable streams of any size, limited lumber resources, no metal or mineral resources, lacking in coal reserves, and at a grave competitive disadvantage in its raw material supplies,

Boston's past and present industrial preeminence is a triumph of intelligence over apparently insuperable obstacles.

An outstanding trait in the industrial history of the city has been the adaptability of its manufacturers to conform to changing conditions. When the play of economic forces, new discoveries and inventions, or a belated realization in more favored sections of their own economic advantages, have rendered established lines no longer profitable, the enterprise of Boston industrialists has quickly asserted itself by recognizing the folly of further futile efforts to force water to run uphill, and their resourcefulness has been applied to new and usually more profitable activities.

When the discovery of vast interior deposits of economically recoverable iron ore forced the abandonment of a multitude of iron works built around the meagre deposits of bog iron ore, and when steam and steel superseded sail and wood, and curtailed Boston's foreign carrying trade, the Jeremiahs of those days also lamented the decadence of the city and the glories of the past.

It was then that Boston capital was transferred to the building of railroads beyond the Mississippi, and those who gloat in looking backward delight to recall that a generation ago three western railroads—the Chicago, Burlington & Quincy, the Union Pacific, and the Atchison—were all built with New England capital, and were administered by Boston executives and directors, who maintained the principal offices of these systems in the Hub. There was considerable compensation for the loss of the C. B. & Q. office when James J. Hill paid \$214,000,000 for that road, as the greater part of that sum was clear profit to the local investors.

When the Union Pacific and Atchison lines found themselves in financial distress the losses sustained by New England owners of the stock probably more than equaled the profit in C. B. & Q., so that the removal of the offices of these two roads from Boston was not deeply regretted.

But the critic who sighs for the return of the golden days of that generation takes no cognizance of the fact that there have been created new local industries, not one of which existed when these railroads were dominated by Boston money, whose capital stock is selling today for five times what Hill paid for the C. B. & Q. line. Four Boston companies alone, all created in the present generation have capital stock that is selling today for approximately a billion dollars, nearly all of which represents clear capital gain to Boston and New England investors of the current period—the United Fruit Company incorporated in 1899, now selling for more than \$350,000,000; the Gillette Safety Razor Company, incorporated in 1901, now selling for upwards of \$200,000,000; the United Shoe Machinery Corporation, incorporated in 1899, now selling for over \$160,000,000, and Drug, Inc., successor to the United Drug Company, incorporated in 1903, now selling for \$280,000,000.

The nothing less than sensational success of this quartet of Boston corporations is due to the business skill, acumen, aggressiveness, and inventive and creative genius of present-day Bostonians and New Englanders, and their record is but typical of what has been and is being done by hundreds of Boston industries of today—some large, some small, some, like these four, owned by many stockholders, and others closely held but about which the general public knows little or nothing.

In the metamorphosis that has enveloped the larger cities of the coun-

try, Boston has stood aloof and has been true to Governor Winthrop's admonition that "we shall be as a city upon a hill; the eyes of all people are upon us."

Having set out consciously and deliberately to be a peculiar city it never had and it has not yet, the least intention of imitating New York, Chicago, Philadelphia, or any other self-styled metropolis. If it is to regard the larger community as the more important, then Boston is guilty of provincialism, but if some standard other than bulk is accepted, then it may be termed genius, for surely the city has expressed itself in industry, religion, politics, literature, and commerce.

In Boston, more than in most American cities, the belief that power carries obligation has been developed to a high degree until a veritable tradition of unpaid public service has been evolved and commissions whose personnels carry nation-wide prestige perform tasks of profound importance to the general welfare.

Boston is the quintessence of New England—New England tempered with the sea, New England facing without quailing the danger and the romance of trade with all the ports of the world.

Although steam drove her clippers from the seas, the loss of her commercial supremacy on the Atlantic seaboard was not the fault of Boston, but was the price exacted by the Civil War.

The average Bostonian faces the future, if not with elation, at least with confidence, and what he may seem to lack in progressiveness is made up in staying power. In casting about for new industries to replace those that are decaying it decides to specialize, to make finer goods, to inject more art in industry, and to become the industrial France of America—a simile that the reader need not laugh at, because if any one dare doubt the esthetic integrity of Boston let him look at our doorways, ship models and pewter porringers, and forever suppress his smile.

What helps continue the thought of the Bostonian that in the end all will be well is the way in which the city handles its immediate and pressing problems. Despite its crooked and narrow streets it expedites its congested traffic well enough to kill twelve persons annually for each 100,000 inhabitants, as against upwards of sixteen in New York City and more than twenty in Chicago. What is more it has developed belt thoroughfares that many another large municipality may well examine. Its health units, established under the \$11,000,000 bequest of one of Boston's industrialists, George Robert White, are models of their type.

No overpowering cubes of steel and concrete frown down upon the Bostonian and consequently the atmospheric pressure of population does not weigh heavily upon his lungs. He breathes freely, and can see the sky.

Boston has no acute desire to be different from what it is today and its struggle is not to change, but rather to maintain its identity in the dizzy maze of progress. Even the Boston Common squirrels have no desire to become wildcats, and they are tamer and more placid than their Central Park relations.

THE BEGINNING OF INDUSTRY IN BOSTON

A year before Boston was settled as a town, in 1630, the manufacture of cordage was begun here by John Harrison, this industry appearing to have antedated the rebuilding of the Watertown wind-mill, within the

limits of Boston, in 1632, because on its Watertown site "it would not grind but with a westerly wind."

In 1636 two wind mills were built in Boston, and another in Charlestown, the latter being blown down in 1648.

While it is asserted in the Massachusetts Historical Collections that "the first water mill built in Dorchester, and the first in the Colony, was erected by Mr. Stoughton by leave of the Plantation on the Neponset River, in the year 1633," a record of the Court made five years earlier in which "Roxbury is enjoined to repair the other way toward the *Dorchester Mill* upon paine of £20 forfeitt" seems to indicate that a mill existed still earlier in Dorchester. The earliest mention of Stoughton's mill, found in the Records, is an entry to the effect that "Mr. Israel Stoughton hath liberty granted him to build a myll, a ware, and a bridge over Neponsett River, and to sell the alewives he takes there at 5s the thousand." In the fall of 1634 the first bushel of grain ever ground by water-power in New England, was turned out at Stoughton's mill.

A canal, known as Mill Creek, which originally divided the central part of Boston from the North End, was created in 1631, and furnished a Tide-Mill. A causeway across the neck which separated the tide-water, at Dock Square on the east, from a cove running up on the north almost to Hanover Square, converted the cove into a large mill-pond, which flowed the area between Charlestown, Merrimac and Hanover streets, and Mill Creek, and through the neck, admitted the tide-water to the mill.

The General Court was presented in 1631 with a specimen of rye ground in this mill. Up to that time the only grain the colonists of New England had cultivated was Indian corn. Within ten years thereafter, wheat became an exportable article from Massachusetts to Portugal.

A grist mill was built at Roxbury in 1633 by Mr. Dummer and five years later he was granted the exclusive right of maintaining such a mill within the town, provided he kept it in proper condition to grind corn, while the town obligated itself to send all corn raised within its limits to the mill to be ground.

In 1645, another grist mill was erected in Roxbury, a committee having been appointed by the town to procure a mill to "grynde the corne," for which an appropriation of £20, in merchantable pay was made, while ten acres of upland and six acres of meadow, with freedom from all rates for a period of seven years, were also granted.

In 1679 the town of Roxbury granted twelve acres of land for another mill. Seven years later "the towne being sensible of the great want of another corne mill," a committee was appointed to view such place or places as were considered convenient "for ye setting up of a mill."

In 1679, the town granted twelve acres of land to John Emery, Jr., provided he build and maintain a corn-mill within a year and a half thereafter.

It is probable that tanneries were early established in Boston, Charlestown, Watertown, and other of the towns that were among the first to be settled, as the General Court appointed two searchers and sealers of leather, in Watertown, as early as 1638.

George Hun of Boston, a tanner, was made a freeman, in 1637, but died three years later, and Jeremy Houchin, or Hutchins, also a tanner, took the freeman's oath in 1640, while William Copp, a shoemaker, the

owner of Copp's Hill (previously Snow), at the North End, in Boston, became a freeman the following year.

In 1662, John Heyman, of Charlestown, received legislative permission to manufacture ropes and lines, and two years later Joseph Jenks, Sr., entered into a contract with the Selectmen of the town of Boston "for an ingine to carry water in case of fire," which was undoubtedly the first attempt to manufacture or use a fire engine in America. Few such machines were built in Europe until after that year, and they were not used in Paris until nearly fifty years later.

The first law securing the benefit of copyright, in this country, was enacted in 1672, when the General Court of Massachusetts, granted to John Usher, a Boston bookseller, the privilege of publishing on his own account, a revised edition of the Laws of the Colony.

The first local worsted mill of which there exists any record was established in 1695, by John Cornish, a comber, dyer, weaver, and fuller, who used two combs, and wove with four looms. The spinning was done by the wives of farmers, who on market days called at the mill for the clean top wool from which the noil had been removed, and later returned with the spun worsted.

About the beginning of the eighteenth century, Edward Holyoke owned and operated a wind mill on Purchase Street, near Fort Hill, which he afterward sold to Richard Woodward.

In 1701 John Arnold requested permission to erect a windmill on Fort Hill, and was required to pay grist-rent to the Selectmen, as his mill was located "on the Town's land," and thirty-nine years later, a wind mill was removed from Roxbury, and located on the same hill.

In April, 1704, Bartholomew Green began the printing of *The Boston News-Letter*,—the first successful attempt to establish a periodical in the Colonies.

THE MILTON AND DORCHESTER PAPER MILLS

Most authorities are in agreement that the first paper mill erected in Massachusetts was built in 1730, by Daniel Henchman, a bookseller and publisher, Benjamin Faneuil, Thomas Hancock and others of Boston, who were induced to begin the industry by the General Court. A few historians assert that a paper mill was erected in Massachusetts as early as 1717, and three years later paper valued at 200 pounds was produced, but there seems to be no confirmation of this legend.

By the terms of the license granted by the General Court, Henchman and his associates were obliged to produce during the first fifteen months of operation of the plant 140 reams of brown and sixty reams of printing paper, and at least 500 reams, including twenty-five of writing paper, each year thereafter.

The mill was erected at Milton, on the Neponset River, and successful operations were carried on until the Revolution.

In 1731, Henchman presented to the General Court samples of the paper produced. During the following year English paper merchants, learning that the plant was in successful operation, registered a complaint with the British Board of Trade on the ground that the local production constituted an infringement of their business.

The Milton mill where Henchman and his associates began the manufacture of paper, had various owners and operators up to April 1, 1801,

when Isaac Sanderson, of Watertown, took it over and successfully carried it on for many years. Here, in September, 1803, he manufactured, for the use of the Boston Custom House, the first folio and quarto letter paper ever made in New England. In 1817 he erected a new paper mill just below the site of the old plant, and installed a wrought-iron tub-wheel, the first iron water-wheel used in the vicinity of Boston, and, in 1827, he added a paper-making machine, the second used in or about the Hub.

In 1830, while lying in the beach grass off Cape Cod, waiting for birds to pitch to his decoys, he broke off some grass and casually chewed it. Observing it after it had undergone mastication, he reached the conclusion that it could be made into paper, and collecting a quantity, he carried on some experiments and found that his expectations could be realized, the result being a paper and paste-board valuable in many lines and inexpensive to produce.

The Sumner family were early associated with the paper industry and when William Sumner died, in 1836, the firm composed of Edmund Tileston and Amor Hollingsworth came into possession of his property, having previously acquired both the McLean and Boies Mills. Two years later, Tileston & Hollingsworth purchased the only remaining mills on the old Boies privilege, which then belonged to Amasa Fuller and Jeremiah Smith Boies, respectively. Thus the mill property, which was formerly owned by Jonathan Jackson was again united, after having been separately owned for seventy-eight years.

On April 22, 1790, James Babcock, of Watertown, described as "paper-maker," erected, on the Daniel Leeds water-power privilege where the latter had operated a snuff-mill, the second paper mill in Dorchester, deeding to Samuel Leeds, a son of Daniel, and to Michael McCarney, each one quarter of the new mill. About the time the plant was completed, Babcock died, and Abel Alline succeeded to his share in the venture, and with Leeds and McCarney carried on paper-making.

In 1797 a new company was formed and between that year and 1823, when Tileston & Hollingsworth bought the plant and carried it on with their other mills, there were numerous changes in ownership.

In 1829 the Tileston firm disposed of their interest in it to Jesse Lyon and Jeremiah F. Daniels, of Newton, who removed the old fashioned vats and presses, installed a paper machine, and began manufacturing under a new process. In 1843, Edmund Baker, who had acquired it, sold the property to his son, Walter, who leased the plant to Tileston & Hollingsworth.

WALTER BAKER & COMPANY INC.

It is not difficult to attribute a reason for Boston's supremacy in the chocolate manufacturing field, since the commodity was first manufactured in the British Provinces of North America, in 1765, at an old powder mill, on the Dorchester side of the Neponset River, long known as Milton Lower Mills by Messrs. Boies, Wentworth & Storer. Fifteen years afterward this pioneer plant came into the possession of Dr. James Baker, and the modest beginning then made of a new industry has developed into the world-famous establishment known as Walter Baker & Co., Inc., which, in 1928, became a unit of The Postum Company. The original plant was connected with a water-power sawmill, and the enterprise was regarded as a somewhat doubtful experiment at the outset. John Hannan, an Irish im-

migrant, who had learned the business of chocolate making in England, was its sponsor, and on his death in 1780, Dr. Baker bought the plant, and employed Edward Preston to manufacture chocolate for him.

As the demand increased, Dr. Baker erected another mill, at Sumner and Connor's Dam, and placed Nathaniel Blake in charge of that unit. In 1791, he fitted up part of David Vose's paper mill with equipment for the production of chocolate, and moved there with his son and partner, Edward Baker.

In 1804, Dr. Baker retired, leaving the business entirely in the hands of his son, who hired the mill where Hannan first began the manufacture of chocolate, and in 1806, Edmond Baker built a new mill, and seven years later, a granite structure. In 1818, he admitted his son, Walter, to partnership, and the father retired in his son's favor six years later.



PLANT OF WALTER BAKER & COMPANY, LTD., DORCHESTER

On the death of Col. Walter Baker in 1852 Sidney B. Williams, who had been his partner for some years and was his brother-in-law carried on the business for two years, and upon his decease, in 1854, Henry L. Pierce, a relative of Walter Baker, who had been a clerk to Messrs. Baker and Williams, first became lessee, and later sole owner, and, during the forty-five years of his control he raised the small, local concern to the position of the leading industrial enterprise of its type in the world.

For eleven and a half decades it was operated as a partnership or as the property of a single owner, but in 1895 the business was incorporated, and three years later a special charter was granted it by the General Court. The little stone mill, erected in 1849, on the site of the original building, long since gave way to imposing structures of brick and stone, the plant comprising six mills on the Dorchester and Milton sides of the

Neponset, where more than 500,000 square feet, or about eleven and one half acres of manufacturing floor space, are utilized.

It seems to be the province of sentimentalists to bewail the relinquishment of control of a pioneer Massachusetts enterprise to a corporation, whose habitat is without the territory known as New England, but those who are interested in the future, rather than in the past, rejoice whenever fresh evidence of faith in a local enterprise is shown by outside business leaders. And so it was when, in 1928, the Postum Company, Inc., acquired Walter Baker & Co., Inc., because the transfer demonstrated that the directors of the purchasing corporation were "bulls" on the Bay State, and their action indicated that they had sufficient faith in the future of this section to warrant a very sizable investment of capital.

There has been observed in the northeastern part of the United States during the past few years something akin to a scramble of public utility interests to acquire New England properties.

The Insull and Mellon families have not been commonly charged with a lack of business sagacity, and both have invested heavily in New England, as have others prominent in the utility field. Electric light and power, and gas systems as well, are in the highest degree permanent investments, and their purchase may perhaps be regarded as even reflecting greater faith in the future of this section than the acquisition of a chocolate factory.

The premature mourners who point to the southward trek of cotton manufacturing, or to the westward movement of shoe production, and who prepare to draw the curtain around the sinking patient's bedside, cannot but observe that their poignant grief is sadly misspent as they note that Bay Staters seem to continue to rally, to live comfortably, to consume increasing quantities of merchandise, and to add to their sizable bank balances. They are nonplussed as they study the figures of railroad traffic, analyze the bank clearings, examine the savings accounts, scan the building construction records, and measure the life insurance sales—all telling the story of continued expansion and prosperity.

These amateur economists are prone to overlook the fact that a vast array of industries may flourish nearly as well in one locality as in another. While meat-packing plants are usually established in live stock-producing centers, a chocolate factory may be as prosperous in Boston, as in Chicago, or San Francisco, and perhaps a bit more so.

Massachusetts offers the chocolate manufacturer ready access by sea to his raw materials and to the world markets, a stimulating climate for his workers, unexcelled banking facilities and a great domestic market.

A study of the dividend record of the Walter Baker Company, Inc., over the past twenty-five years is interesting. Up to 1916 regular payments of 8% per annum were made. From 1917 to date the "regular" rate has been 6% a year. In 1917, however, a 200% stock dividend was declared, bringing the capital stock to \$8,250,000 and making the current rate equivalent to \$18 per share on the old stock. The list of "extras" is impressive. In 1903 the extra dividend amounted to 1%; in 1904 and 1905 it was 2% in each year; in 1906 extras were 12%; 1907 2%; 1909 4%; 1910 12%; 1911 10%; 1912 to 1914 8% a year; 1915 18%; 1916 8%, the last extra being paid in 1923 when \$2 per share over regular payments was disbursed.

Dividends each year have been covered by a good margin. For 1926

the earnings were \$9.45 a share against dividends of \$6. Surplus earnings brought profit and loss surplus at the close of 1926 to \$3,256,682.

With the exception of the war years, the sales of the company have averaged around the same figure for years, but during 1928-29, the business showed a decided improvement through the introduction of more modern sales methods. The Walter Baker Company, Inc., virtually dominates the export field today.

By far the largest portion of its business is in chocolate coatings for candy manufacturers. About 50% of the poundage output of the Dorchester plant is in coatings, the balance of the production being 25% breakfast cocoa; 15% unsweetened chocolate and 10% sweetened chocolate.

Upwards of 750 employees are constantly carried on the company's payroll and an auxiliary plant is operated in Canada. The principal executive offices are at 45 Broad Street, Boston, and the business offices and plant in Dorchester, with branch houses in New York and Chicago.

Beginning in 1853 Walter Baker & Co., Ltd., received fifty-seven highest awards at international and local expositions in Europe and America, including the Paris, Vienna, Toronto and Ottawa fairs.

The concern has never employed coloring matter, chemical solvents or adulterants of any kind in the preparation of its cocoa and chocolate products, and much of the machinery in the Dorchester plant is of its own invention.

In 1928 the Aberthaw Company erected at the Dorchester plant, a three story brick and cement structure, 103 by 67 feet.

OTHER LOCAL INDUSTRIES OF THE EIGHTEENTH CENTURY

In 1768, a type-foundry was established in Boston by a Scotchman, named Michelson, who produced types which were said to be equal to any imported from Great Britain.

Joseph Mann advertised in the *Boston Gazette*, in 1773, that he was making pure chocolate and grinding cocoa, and in 1794, Mr. Welsh was turning out 2,500 pounds of chocolate daily, at his mill in the North End of Boston—both concerns doubtless being offshoots of the original Dorchester enterprise.

By 1787 six paper mills were being operated on the Neponset River, and seven on the Charles River, at locations not far from Boston proper.

THE BOSTON PLATE & WINDOW GLASS COMPANY

In the industrial development of Boston and New England, no phase of building has played a more important part than glass. In the era of sunlight and sanitation in which we live nothing is more conducive to health and happiness indoors than the availability of sunlight by the more and more extensive use of glass.

In 1781, Robert Hewes, of Boston, started experimental glass making in the little village of Temple, N. H., where he erected a small furnace, with surrounding pot houses, drying sheds and other necessary structures. Born in Boston in 1751 of English parentage, Hewes as a young man came into a considerable fortune on the death of his father. The elder Hewes had been a tallow chandler, an important and dignified occupation in Colonial days. Versatile, polished and abounding in energy and ambition, he found no inclination to carry on the business of his father.

By chance a copy of Chambers' Encyclopedia fell into his hands and as he was casually studying it, his eye was arrested by a five page account of the composition, chemical analysis and manufacture of glass. He became possessed with the idea of making the commodity, and although his friends tried to discourage him, he began experiments and was soon engrossed in the various formulae.

Prior to 1781 men were born, lived and died within the confines of what are now the New England States, who had seldom, if ever, seen the substance called glass and had never themselves used it. Glass window panes were not introduced into this country from England until as late as 1829. In the homes of the well-to-do, from about 1640-1650 two fairly ample windows were built into each story of the clapboard structure and heavy greenish rhombic glass set into the leaden frames. In the homes of the poorer folk, the windows usually opened casement wise, the panes being diamond shaped and most of these were without glass of any sort. It is stated on good authority that in Maine as late as 1745 there was not a house with a pane of glass in it.

At this period, the English embargo on manufacture in the Provinces was rigid and drastic. At the same time the prohibition of all glass shipments from foreign ports had been keenly felt by our people. Young Hewes believed that he could partially fill the void. Following the completion of the works, the furnaces had been fired for only a few melts when trouble began. His recruits, a ragged band of Hesse-Waldeckim deserters from the British Army, men who were supposed to know something of the mystery of glass making, proved a carousing, hard-drinking lot, whose actions disgusted the sober townspeople of Temple. Hewes was beginning to worry over the situation, when "the fireman got drunk and conflagration resulted." The glass works were consumed. Hewes made a second attempt but being short of ready funds, he drifted until he met assistance from an unexpected source.

Charles F. Kupfer, a practical glass maker, came to Boston from Brunswick, Germany in 1785 and soon became acquainted with Hewes. Their meeting led to the formation of the Essex Glass Work and plans were formulated whereby experienced artisans were to be brought to America from Brunswick and the most up-to-date improvements were to be installed in the factory. Kupfer sailed for Germany but found it more difficult than he anticipated to entice the Brunswick glass workers to come to Boston. After considerable scheming, a group skipped over the border on a dark night, concealing their tools in their clothing and finally reached Massachusetts after a long voyage. As they entered Boston Harbor, they were greeted by a large crowd of enthusiasts, who formed a procession from Long Wharf, through State and Washington streets to the works.

In 1787 the General Court of Massachusetts granted the company the exclusive privilege of glass making in the State for a fifteen year period. Those interested in the venture besides Kupfer and Hewes were Edward Payne, who was elected "Treasurer to the Proprietor of the Glass Company," Samuel Whalley and Richard Hunnewell. Hewes became the manager and Kupfer the superintendent or "gaffer" of the works.

The factory stood on the corner of Essex and Kingston streets, near the present site of the South Ferry Station. The first glass house was pyramidal in shape but its construction and form did not suit the Brunswick blowers. It was razed and immediately replaced by a spacious and

properly constructed building, the outside of which was wood and the interior of brick.

The dimensions of the furnace room were 100 feet in length by 60 feet in width. The making of glass in quantity did not get well under way until 1792. From the beginning the operations of the firm met with success and by 1798 the factory was producing as many as 900 sheets of cylinder glass a week. The glass was advertised as "equal or superior to importations."

Demand from all parts of our country was created for Boston window glass and at the beginning of the nineteenth century, this glass was being sold at \$1.75 a sheet, the annual production amounting to \$76,000.

In 1809 the firm was reorganized and incorporated and given the name of the Boston Crown Glass Company. In 1811, the new company planning to increase production, started building operations on the South Boston shore, expecting to man the new plant with a few of their best Essex Street workmen, augmented by foreigners.

An agent was sent to England to secure recruits, but all plans were completely upset by the outbreak of the War of 1812. The operatives could not ship for America, supplies were cut off, orders were remanded and both plants were shut down. After the ending of hostilities, the Essex Street factory was reopened but the losses had been so severe that the management was not able to operate the South Boston plant.

Samuel Gore, one of the firm, was a brother of Christopher Gore, who was Governor of Massachusetts in 1809-10. Samuel had been a member of the Tea Party of 1773. The other stockholders were men of equal determination but it took more than determination to succeed in the glass business. Outside forces were more powerful than the will of man, and in 1815 the works were blown down in the great gale which swept the Atlantic seaport and the buildings caught fire from the furnaces. In 1822 large and extensive buildings were erected on the South Boston property and two years later the firm was enlarged and the concern was incorporated by Jonathan Hunnewell, Samuel Gore, Samuel G. Whalley, Henry G. Foster and John S. Foster. The new board interfered with the management which had been in charge of Kupfer, and he resigned, sold his shares of stock and, in 1824, with Caleb G. Loring, of Boston, as a partner, established the mercantile glass house of Kupfer & Loring.

With the withdrawal of Kupfer, the concern went to the wall through lack of proper management, hastened by litigation between Hunnewell and Kupfer regarding endorsements of certain notes, which Kupfer was successful in defending through the able efforts of his counsel, Daniel Webster.

Although another attempt to successfully manufacture glass in this country had failed, the formation of the glass jobbing house of Kupfer & Loring marked the beginning of the oldest and one of the largest glass houses in New England. It continued in business until 1830, when Kupfer died, and from 1830 to 1837, the concern operated under the name of Caleb G. Loring & Co. In the latter year, Caleb G. Loring retired, and the pioneer glass house in the United States was sold to Tuttle & Garfield, dealers in flat glass who had started in business a few years previous. They in turn were succeeded by Lambert Bros., when, in 1850, Henry Lambert, junior partner of Tuttle, Garfield & Co., formed a partnership with his younger brother, William B., and bought out the old firm.

During the next twenty years, several other glass jobbers began business in Boston, the principal of which were Damon Sherburne & Co., who later became R. & W. Sherburne, located at 20 Canal Street, afterwards Reuben Sherburne, who had as partners his two sons, Frank S. and Edward C. Sherburne; Hills, Turner & Harmon, founded in 1866, which became Hills, Turner & Co., and who were located at 39 Elm Street, Boston, at which time Lambert Bros., were located on Brattle Square. The founder of Hills, Turner & Harmon, Edwin A. Hills, still lives in Boston, and should properly be considered the dean of the glass business, he being the oldest living glass man.

In 1893 these three concerns, after years of strenuous but friendly competition, united and the Boston Plate & Window Glass Company came into existence, and moved to its present location in South Boston. Of the original incorporators, Edwin A. Hills, Daniel T. Kidder and George W. Hastings alone survive.

The corporation occupies its own building on A Street, covering $2\frac{1}{2}$ acres, with a railroad siding, which together with its easy access to South Boston wharves, makes its merchandise easily available, whether arriving from American or foreign manufacturers. The business of the company is diversified and not confined to any particular trade. Its product finds its way to hardware dealers, automobile and furniture manufacturers, picture and art dealers, interior decorators and during recent years it has furnished the glass for the Employers' Liability Building, the Police Headquarters, the new home of the Pettingell Andrews Company, the Chamberlain Garage, the Elks Building, the new Western wing of the Art Museum, the Statler Hotel, the Motor Mart Garage, the Public Service Building and the Industrial Building at the North Station, all in Boston; the Merchants National Bank in Cambridge, the Mechanics Art Building in Worcester, the Union Institute of Savings in Lowell, the Lying-In Hospital in Providence, and many other buildings all over New England. It carries in stock a large assortment of window, polished plate, rough, ribbed, wired and figured glass and manufactures one of the best commercial mirrors on the market. It specializes in metal storefront construction and is the exclusive distributor for Vita Glass, the successful medium for the transmission of the vital and health-giving ultra-violet rays.

The corporation has capital of \$500,000 and employs 100 hands. D. T. Kidder is president, F. A. Turner, Jr., secretary, and Arthur F. Whalen, treasurer.

THE EARLY MANUFACTURE OF CARDS

Giles Richards is supposed to have applied the inventions of Oliver Evans, of Philadelphia, to machines producing cards he installed in his factory, in Boston, which derived its power from a windmill. One of these machines tended by a single person could cut and bend the wire for 240 cards in twelve hours.

Richards factory was inspected by President Washington during one of his tours of the east, and at that time 900 persons were employed in the mill, and 63,000 pairs of cards were produced annually. Writing of these machines, in 1789, Washington describes them "as executing every part of the work in a new and expeditious manner, especially in cutting and bending teeth, which are done at one stroke."

Mark Richards, brother of Giles, was engaged extensively in the mak-

ing of cards near Faneuil Hall, Boston, in 1794, and Amos Whittemore was operating a card factory at the same period, these three enterprises supplying four-fifths of the cards then produced in Massachusetts. Altogether 2,000 children and sixty men were employed in the three plants.

Eleazer Smith, of Walpole, conceived a machine for making cards that continued the operations of bending the teeth and piercing the holes in the leather. For a time Whittemore was employed in Giles Richards' card factory and there made several improvements in card-setting machinery. Returning to Walpole he began work upon what he termed his "grand machine to stick cards." Receiving visitors from time to time to whom he showed the uncompleted model, he explained to them the mechanics of the device then nearing completion. It consisted of an iron bed-plate, twenty-four inches square, with wrought-iron posts for the center and working parts. He had succeeded in making it actually prick the leather, cut the teeth and set them in straight and was about to apply his ideas for putting on the second bend to the teeth, when he learned in 1797, that a patent on a card machine had been granted to Amos Whittemore, a contemporary, who had been his most frequent visitor and one who had followed him closely in working out the Smith model.

Forestalled, disappointed, and broken-hearted, Smith never recovered from the blow.

Whittemore was a skilled mechanic and of great inventive genius. Possibly he had his own well-laid plans for perfecting his own machine, but had he not so constantly visited the workshop of a rival fully as skillful as himself, more honor would have accrued to him for the invention of a machine that was described as being a model of "construction, precision of movement, rapidity of performance, and perfection of execution" and of which one observer of the device said "its complicated performance can be compared with nothing more nearly than the machinery of the human system."

In 1797, William Whittemore became a partner in the enterprise set up by his brother, Amos.

That year there were three smaller card factories in Boston, and the wire used in all the local plants was manufactured at Dedham. The annual local production of cards in the several plants was about 144,000 cards.

In 1789 the Boston Sail Cloth Factory was incorporated by the General Court, and encouraged by a bounty upon its products, was established on Frog Lane, at what is now the corner of Tremont and Boylston Streets, in a building 180 feet long and two stories high which was erected for the enterprise.

We are prone to think that our present admirable system of industrial relations is the creation of the twentieth century and indeed while it has attained its greatest momentum in the last twenty-five years the idea of employee representation now in operation in many of our factories is but the outgrowth of a plan which was in vogue in the Frog Lane factory of 141 years ago, where the weavers and spinners each formed into a society for mutual aid of the members and set up a code of by-laws for their governance. Quarrels, profanity, or other misconduct were immediately adjudged on the spot by a jury of the weavers or spinners, and a fine, deducted from the wages of the offender, was turned into a common fund for the relief of sick members. Careless workmanship was penalized

in a similar manner, and the goods, if unsalable, were charged to the offending artisan. These measures, designed to promote industry and self-government, were extremely successful, and the concern was enabled to produce the finest quality of duck ever seen in America, and to market it at a price below that attached to imported sail-cloth.

The ship *Massachusetts*, of eight hundred tons, was equipped with sails and cordage wholly of Boston manufacture. The factory, in 1792, produced about two thousand yards of duck weekly, and employed 400 hands. Its annual volume for a number of years after was between two and three thousand bolts, of forty yards each, worth thirteen dollars per bolt.

President Washington, who on all occasions manifested an interest in the struggles of the infant manufactures of the country, and who visited many factories thus speaks of the local duck manufactory and of the card factory before mentioned, under date of October 28, 1789: "They have twenty-eight looms at work, and fourteen girls spinning with both hands (the flax being fastened to the waist). Children (girls) turn the wheels for them, and with this assistance each spinner can turn out fourteen pounds of thread per day, when they stick to it; but as they are paid by the piece, for work they do, there is no other restraint upon them but to come at 8 o'clock in the morning and return at six in the evening. They are daughters of decayed families, and are girls of character—none others are admitted. The number of hands now employed in the different parts of the work is*, but the managers expect to increase them to*. This is a work of public utility and private advantage. From hence I went to the card manufactory, where I was informed about 900 hands of one kind, and for one purpose or another, all kinds of cards are made; and there are machines for executing every part of the work in a new and expeditious manner, especially in cutting the bending teeth, which is done at one stroke. They have made 63,000 pairs of cards in a year, and can undersell the imported cards—nay, cards of this manufactory have been smuggled into England."

The Boston Sail-Cloth Factory was prosperous until about 1795, when the bounty was withdrawn and the business gradually died. At about the same period sail-cloth plants were set up at Haverhill, Salem and Nantucket where the shipping interests of these municipalities and the then unsettled state of the foreign commercial relations of the youthful American republic, had a tendency to foster developments of that type.

The year 1790 found Colonel Paul Revere opening his Lynn Street foundry, where brass and iron cannon, stoves, hollowware and bells were cast.

In 1793 Graham's comb factory, located on Charter Street, was turning out products of excellent workmanship.

As early as 1794 Boston was manufacturing chocolate, soap, candles, rum, loaf-sugar, cordage, duck twines and lines, cards, fish-hooks, combs, stained paper, stove ware, glass, etc.

Four factories were exporting spermaceti candles of superior quality, the privilege of manufacturing commodities of this type having been granted to Benjamin Crott as early as 1751. Soap and tallow candles had been produced for many years prior to that date, but as the result of

* Figures were not filled in by Washington.

newly invented American machines, greater efficiency and considerable saving of cotton had been effected in the business of candle making.

At that period Boston had thirty distilleries and seven sugar refineries, the latter capable of turning out on the average 100,000 pounds of sugar each. Paper hangings were made in sufficient volume to care for state needs, and to permit exportation to other states. The Fenton stone pottery on Lynn Street, produced Liverpool ware, the clay being imported from Perth Amboy, N. J. Chocolate production has been expedited locally as the result of recent inventions, and was manufactured from West India cocoa. Calico printing was carried on, but the production of pot and pearl ash, which had been a principal industry for forty or fifty years, had ceased, due to the scarcity of wood—the first recorded evidence of the loss of timber supplies.

Hat production was important, the fine beavers manufactured being considered preferable to those of English make.

In July, 1794, Boston experienced one of its most disastrous fires, when the large rope walk owned by Edward Howe, and located near Gray's Wharf, was destroyed, with six other factories, a half of the total then in operation in Boston, in addition to approximately 100 other buildings, including forty-three dwellings. The largest rope walks, located at the west end, were not damaged, one of the latter being 160 fathoms long, and capable of turning out a cable of 140 fathoms.

The selectmen requested that no more rope walks be erected in the heart of the town and tendered the sufferers the use of the west side of Boston Common, where six factories were built, which were destroyed by fire, on February 18, 1806. Five were rebuilt, but these were burned in 1819.

The first patent for manufacturing cordage was granted on June 16, 1794, to George Parkinson, who, in 1791, had patented a machine for spinning flax and hemp. There existed in Boston as early as 1792 a company manufacturing twines and lines of every size, and employing fifty hands.

In 1799 William M. Goodrich, a native of Templeton, where he was born in 1777, removed to Boston and became the first American builder of organs, continuing in the business until his death, in 1833.

From 1803 to 1833 only three church organs were imported into Boston, so completely did Goodrich dominate that type of production. By 1853 three organ factories had come into existence in the vicinity of Boston—the Appleton enterprise, in Reading; the Stevens organ factory, in East Cambridge, and the Simmons & Hook Company, in Boston.

AMERICA'S OLDEST CONTINUOUS PAPER CONCERN THE TILESTON & HOLLINGSWORTH COMPANY

The Tileston & Hollingsworth Company is unique in several particulars—being unapproached by any other enterprise in the paper industry in age, as well as being one of the few paper mills operating within the corporate limits of a big American city, and being owned and managed today by so progressive a group as to enable it to produce and market a greater volume of commodities than at any time in its entire history of 129 years.

While the vast majority of paper manufacturers have abandoned the centers of population, the Tileston & Hollingsworth Company is enabled,

through affiliation with the Penobscot Chemical Fiber Company of Oldtown, Me., to secure the soda and sulphite fiber it requires. This connection, together with its own equipment for using rags, gives its present plant the raw material for filling almost any specification in the manufacture of paper.

It was in 1801, just at the dawn of the nineteenth century, that Mark Hollingsworth leased from Jeremiah Smith Boies a paper mill located on the Neponset River, just below that part of Boston, now known as Mattapan. From that year to this the name of Hollingsworth has been continuously identified with the paper industry of Massachusetts, and of New England, and it is an historical fact that three well-known paper-producing corporations would not today be in existence had it not been for the entrance of Mark Hollingsworth into the field, as a very young man in the closing years of the eighteenth century.

The Tileston & Hollingsworth Company which upholds the traditions of New England's first paper mill, is the same enterprise of which he was founder and a co-partner, while the Hollingsworth & Vose Company of East Walpole and the Hollingsworth Company of Maine, originally of Watertown, were organized by his descendants.

Jeremiah Smith, grandfather, of Jeremiah Smith Boies, in 1737, assumed charge of the first paper mill set up in the American colonies, and the second in the country, which had begun operations in 1728, and later he acquired complete control of the enterprise.

Some years later through his son-in-law, James Boies he secured the services of Richard Clark who later joined with Boies, the latter having erected another mill, to which he subsequently added a third. The firm of Boies and Clark ultimately was absorbed by Boies and McClean, the latter being a son-in-law of Boies. In 1790 Boies, then alone in business, leased his property to his son, Jeremiah Smith Boies and three years later the latter erected a new mill on the Neponset River, about a mile below Mattapan, and engaged Mark Hollingsworth to take charge. Thus through the succession of interests of the Smith and Boies families, the founder of the Tileston & Hollingsworth Company is linked with the original paper-making plant of New England.

In 1801 Jeremiah Smith Boies retired from active business and Amor Hollingsworth leased the property which he had been operating since 1793. Although but sixteen years of age when he was engaged by Boies, Hollingsworth had learned the trade of paper-making at a mill which had been erected at the first dam built across the Brandywine, in Delaware. Coincident with the lease of the Boies mill, he formed a co-partnership with Edmund Tileston of Milton, and the controlling stockholder and president of the company today, Amor Hollingsworth, is great-grandson of the founder, and a nephew of the third generation of fathers and sons who previously had carried on the business for more than one hundred years.

In 1836, Edmund T. Hollingsworth of Dorchester, and Amor H. Hollingsworth, of Milton, purchased the old Sumner mills in Hyde Park, consisting of a paper mill and a cotton plant. In 1837 the latter structure was destroyed by fire and the owners built another paper mill in its place, which was burned in 1881, but was at once rebuilt by the sons of the former partners.

In 1889 the Tileston & Hollingsworth Company was incorporated with

capital of \$500,000, Amor L. Hollingsworth, grandson of the founder becoming president and John B. Tileston, treasurer. Frank L. Tileston, son of Edmund, and of the third generation of the family in the firm, had been admitted as a partner, in 1880, but five years later he died, after having been active in its management for a quarter of a century. His interest passed to his brother, John B. Tileston, who died in 1898.

In 1897, the company erected a new building called the Hyde Park Mill, which was virtually an enlargement of the facilities of the historic Sumner Mill. The company also owned mills in Milton and Groton at that period.

Amor L. Hollingsworth had the misfortune of losing all his children during an epidemic, and, suffering himself from a severe illness, he finally persuaded his nephew to enter the business, and two years after the death of Amor L., in 1905, Amor Hollingsworth, the nephew, assumed complete control of the corporation. At that time, the low point in the company's business was reached, and Amor Hollingsworth found himself in charge of three paper mills, more or less antiquated in equipment, and lacking in effective production and marketing.

A policy of concentration at the Hyde Park plant was decided upon. A new personnel organization was developed, modern equipment was bought and installed, and new lines added, with the result that the corporation staged a come-back that has been little short of remarkable, the volume of sales made in New England alone in 1926 having been greater than the total sales everywhere in any one year since the concern began its existence, while the total business ran close to that attained during the period of inflation directly after the World War.

Under its new and progressive management the company has been advancing the New England cause in many ways, one of its unique and outstanding contributions being the publication of an annual calendar, the first of which appeared in 1923, the contract for each month's page being given to a different New England printer, with carte blanche orders to express his craftsmanship therein. In 1928 a concrete-brick and steel warehouse was erected which with the equipment installed, represented an expenditure of approximately \$100,000.

Amor Hollingsworth is president, Arthur V. Howland, vice president, secretary and assistant treasurer, and E. H. Clapp, treasurer, and the corporation employs 200 operatives, its Boston office being at 213 Congress Street. It markets direct to the printers and publishers of New England book papers and specialties of the highest grade, including many unusual types of products.

THE PLOUFF CORPORATION

The Plouff Corporation, whose plant is located at Roxbury Crossing, has a history which extends back more than 125 years, as it was in 1804 when Edward Plouff, a worker in metals began business in Ipswich, being followed by a second, Edward, and in 1867, by E. Plouff & Son, and later by A. M. Plouff. The Plouff Company was incorporated in 1922 and today its products include special solders for the automotive industry, including types for filling scored cylinders, for cast iron or aluminum, for body dents, rotor and filling solders, and welding, brazing and soldering fluxes, as well as Richard's resolvent-restringent, S-A1 sealing solder for scaling porous electric welds, and Plouff pure para puncture panacea.

William A. Dixon is president, Austin N. Barber, vice president, J. L. Bixby, secretary, and Frederic H. Plouff, treasurer.

SOME INDUSTRIES OF THE FIRST DECADE OF THE NINETEENTH CENTURY

In 1805 the first carriage reported to have been built in the United States was manufactured by one White, in Dorchester, it being an imitation of an English chariot, but much lighter in weight, and although creditable to the producer, it was found difficult at that time to successfully compete with English and French vehicles.

On June 1, 1805, John Bennock, of Boston, was granted a patent on a planing machine, this being the first recorded issue of a patent on such a device.

The foundation of the Tudor fortune was laid in 1806, when Frederic Tudor loaded at Gray's Wharf, in Charlestown, the first cargo of ice, on board the brig *Favorite*, the consignment consisting of 130 tons harvested on a pond in Saugus, belonging to Mr. Tudor's father, and was shipped to St. Pierre, Martinique. The following year a shipment of 250 tons was made, by the Brig *Trident*, to Havana. Following the War of 1812, Tudor shipped six cargoes of 12,000 tons, and in 1856, the trade had increased to 363 cargoes of 146,000 tons, to domestic and foreign ports.

THE WHITING-ADAMS COMPANY

Seth Whiting, John Wickliff Adams and Artemas Woodward founded at Mansfield in 1808, the brush manufacturing business now operated by the Whiting-Adams Company. A few years later the partners separated, each continuing independently to make brushes for about twenty-five years thereafter.

Early in the thirties, John W. Adams moved his business to Taunton, while Seth Whiting located at Rindge, N. H.

In 1832 John J. Adams succeeded his father, John W. in Taunton, and six years later moved the business to 99 Washington Street, Boston, to the building formerly occupied by Mrs. Atkinson's famous restaurant overlooking Pie Alley, now a part of Thompson's Spa.

At about the same period, Seth Whiting transferred his manufacturing operations to Southboro.

In 1858, the latter's son, John L. Whiting entered the John J. Adams factory in Boston, and fifty years after the founders had established the brush-making business in Mansfield, their sons were found working together in the Hub.

In 1863, John J. Adams removed his factory to New York City, and the following year John L. Whiting formed a partnership under the name of Drinkwater & Whiting. Later, Mr. Adams moved his plant from New York City to Brooklyn, N. Y., where the business of J. J. Adams & Co., was continued until 1908. In 1870, the firm of Drinkwater & Whiting was dissolved, John L. Whiting continuing operations in his own name, and soon afterward his son entered partnership with him and the firm of John L. Whiting & Son was formed, it becoming incorporated in 1892 as John L. Whiting & Son Company.

By a singular turn of the whirligig of fate exactly one hundred years after Seth Whiting and John W. Adams had founded the business in Mansfield their descendants consolidated John L. Whiting & Son Company, and J. J. Adams & Co., under the name of John L. Whiting-J. J.

Adams Company, and in 1928 the corporate name was changed to the Whiting-Adams Company.

For a hundred and twenty-two years the Whiting and Adams brushes have been considered standard equipment for millions of American painters, and the product is used by the largest railroad and steamship lines, the biggest automobile manufacturers and by the U. S. Navy, while many of the principal wholesalers and retailers of brushes in the country handle this company's line exclusively.

The plant at 690 to 710 Harrison Avenue employs upwards of 500 operatives, and the corporation has capital of \$2,000,000. C. L. Stevens is president and Edward M. Hill, treasurer.

THE INVENTIONS OF JACOB PERKINS

On June 26, 1809, Jacob Perkins, the inventor of the nail machine, then residing in Boston, was granted a patent on polishing and graining morocco, and on June 6, 1810, he received letters patent on a mode of engraving to prevent counterfeiting. The forging of bank bills was rife at the time, and was rendered easy by the rudeness of the engraving art. He had patented, in 1799, a stereotype check plate, which it was thought would render forgery nearly impossible, and the Massachusetts Legislature required all bank notes to be impressed by his process. His mode of transferring engravings from one plate to another by means of steel roller dies, upon which he and George Murray, of Philadelphia, soon after jointly patented an improvement, was, in 1808, applied to calico printing, and, about 1820, after having been long in use in this country, his method of engraving bank notes was extensively introduced in England. Perkins invented a steam gun about 1810, which he did not patent.

On March 23, 1813, he was given two patents, one for bank vault locks and one for manufacturing the shanks of screws, and on June 25, in conjunction with Murray, he received another patent covering an improvement on the Perkins dies, and one on June 29, for a copper and steel plate printing press.

On January 16, 1815, Perkins was granted a patent for cutting cylindrical nails and on November 1, another for an improvement in the process.

The next year Perkins and Thomas Gilpin, of Philadelphia, received a joint patent on making water-marks in papers.

The first incorporated company to engage in the leather business was, doubtless, the Hampshire Manufacturing Company of Massachusetts, which was established in Boston, in 1809, with \$100,000 capital. It acquired several local tanneries, the aggregate capacity of which was 16,000 hides per annum.

ATKINSON, HASERICK & CO.

Early in the nineteenth century J. G. Tappan, of Boston, founded the concern now known as Atkinson, Haserick & Co. Later, Henry Edwards bought the business, and in 1823 Charles Stoddard was admitted as a partner to the firm of Edwards & Stoddard. Three years later, upon the death of Mr. Edwards, a partnership was formed by Mr. Stoddard with J. S. Lovering, then a clerk in his employ, dealing chiefly in silks, ribbons and millinery goods, and shortly afterward a Paris house was started,

under the name of J. S. Lovering & Co., which was managed by Mr. Lovering.

In 1846 the latter returned to Boston from France and the firm of Stoddard, Lovering & Co., was formed.

In 1859 F. A. Haserick began business in Manchester, England, and was appointed agent for Stoddard, Lovering & Co., dealing in Manchester fabrics and cotton yarns.

Five years later the Paris house was discontinued, and F. A. Haserick, E. W. Dean and J. L. Barry became partners in the Boston firm and the Manchester business was transferred to that concern. In 1880, Mr. Haserick began business in the textile machinery and wool fields, left Manchester, and came to Boston, at which time the English office was removed to Bradford, England.

The Boston firm became sole agents in the United States of Messrs. Prince, Smith & Son, worsted machine makers, at Keighley, and of Messrs. Dobson & Barlow, Ltd., cotton machinery makers, of Bolton, England.

In 1889, Charles E. Richards, E. W. Atkinson, Arthur A. Haserick and F. S. Coffin were admitted to the Boston partnership, and E. W. Dean, the resident New York partner, retired and founded the shoe-finding firm of Dean, Chase & Co.

From that time on the business of Stoddard, Lovering & Co., was almost exclusively in textile machinery and wool.

In 1890 the business of importing cotton direct from Egypt was begun, and five years later the firm name became Stoddard, Haserick, Richards & Co. In 1908 another change in name was made and the firm became Richards, Atkinson & Haserick. Following the death of Charles E. Richards the style of the firm became Atkinson, Haserick & Co., and in 1914 J. L. Coon became a partner. Three years later Horatio W. Nelson was admitted to the firm.

During the World War the concern purchased for its clients in France and exported to them large quantities of structural steel, electrical steel sheets, gun castings, etc., receiving no commission thereon and making no charge for its services.

In 1924 the firm became a voluntary association, with E. W. Atkinson, J. L. Coon and H. W. Nelson, as trustees. After a successful career of more than a century it continues to act as sole agents in this country for Messrs. Prince, Smith & Son, and the Societie Alsacienne de Constructions Mecaniques, of Mulhouse, both makers of worsted machinery, and for Messrs. Dobson & Barlow, Ltd., of Bolton, makers of cotton machinery, and in Egyptian cotton, it acts as the sole agents for Messrs. Carver Bros. & Co., Ltd., of Alexandria and Manchester.

Upon the retirement of Mr. Nelson, in 1928, Messrs. Atkinson and Coon became the sole trustees.

The Boston headquarters are at 152 Congress Street.

THE HUNT-SPILLER MANUFACTURING CORPORATION, SUCCESSOR TO THE
OLD SOUTH BOSTON IRON COMPANY

For many decades Boston has possessed manufacturing establishments that have been truthfully classed as remarkable, but there have been few more celebrated, or of greater national importance, or of such longevity as the Hunt-Spiller Manufacturing Corporation, which traces its history

back for almost a century and a quarter to the activities of Cyrus and Francis Alger.

In 1809, Cyrus Alger, a native of Bridgewater, then twenty-eight years of age and a descendant of a family of iron founders, which for several generations carried on that business in the vicinity of Bridgewater, purchased a large tract of marsh land, then called the "Boston Flats," reaching to the channel, in Boston Harbor, where he erected the first building which formed the nucleus of his extensive enterprise of later years.

At that period the realty acquired by him was considered of little or no value, but today it is dotted with streets, dwellings and extensive manufacturing whose value runs into many millions of dollars. In 1813, Mr. Alger removed from his original South Boston foundry, located near the junction of Second and Dorchester streets, to Foundry Street.

It was here the Alger foundry cast shot and shell for the United States Government during the War of 1812, the quality of the work executed by him early attracting the attention of the War Department, and, following the conclusion of hostilities, a group of army and navy officers was sent to South Boston to coöperate with him in experimenting with metallic castings and in proving the best design for casting cannon. Alger's Foundry was incorporated under the laws of Massachusetts in 1827, following a special act passed by the General Court the year before and it took the name of The South Boston Iron Company, of which Mr. Alger became president. One of the most practical metallurgists of his generation, he evolved a method of purifying cast-iron which rendered it three times as strong as ordinary castings, and which proved of inestimable value in the manufacture of ordnance, in which he was for many years actively engaged. The mortar-gun, "Columbiad," of twelve inch calibre, with a range exceeding two miles, the largest piece of cast-iron ordnance that had been manufactured in America up to that time—was fabricated under his supervision. It was turned over to the U. S. Government by the South Boston Iron Company and a report of the Ordnance Board of the War Department stated that the cannon furnished by the corporation afforded the most favorable results, while the quality of the metal was unsurpassed.

Alger's method of purifying iron by the air furnace gave to his foundry a distinct advantage in manufacturing iron guns, especially those of large calibre, and his process thenceforth was used in fabricating heavy ordnance. Hence the metallurgical term of "gun-iron" was created.

In 1828 the South Boston Iron Company began the active manufacture of iron ordnance, and in 1834 the first rifled gun to be cast in the United States was made at this foundry of air furnace gun iron. Likewise, Mr. Alger produced at the plant the first bronze gun for the United States Navy for heavy artillery, and also one for the Commonwealth of Massachusetts.

The first of the large cannon of ten, eleven and twelve inch caliber, for the United States Government, were cast by order of the War Department at the South Boston works, under Mr. Alger's direction. One of these pieces of ordnance, of eleven inch caliber, carrying a solid shot of 170 pounds, or a shell of 135 pounds, was first fired 655 times with the former projectile, and 1,306 times with the latter—an enormous endurance record of 1,959 rounds—before it failed, far exceeding any other

record of the Ordnance Department of this or any other country on the globe.

On March 30, 1811, Mr. Alger was granted a patent upon a mode of casting large iron rollers for rolling iron.

He first introduced and patented the method of manufacturing cast-iron chilled rolls, by which that part subject to wear should be hard, while the neck remained unchanged as to strength and hardness, the latter being cast in sand, and the former in a chill or iron cylinder.

Until his advent into the metallurgical field, all the reverberatory furnaces for melting iron were built with hearths reclining from the fire, the metal thus running from the heat. He changed the form of production and permitted the iron to flow toward the flame where the heat would be most intense.

Cylinder stoves were designed by Alger as early as 1822. In 1836 he manufactured the first malleable iron guns made in the United States. He invented the method of introducing a non-combustible material between the fuse and the bursting charge in the shell, and so constituted as to cause it to be detached by the violent concussion following the discharge of the projectile from a gun. He also invented the plan of covering the fuse-hole on the inside of a shell with a wafer or disc of lead, which must be removed previous to the firing of the shell in order to expose the surface of the fuse and permit ignition when discharged from a gun. He also invented and applied the angles to vent-holes in the heads of fuse-cases, thus permitting the escape of gases formed by the burning fuses, and at the same time preventing the entrance of water and the extinction of fuses when firing was done at sea.

He was the originator of an improved method of casting shells, which provided for a metal arbor to support the core, and he designed a hollow arbor which allowed all gases generated by moisture and organic matter to escape, thus preventing porosity in the shell.

His plant ultimately became one of the four principal foundries in the United States engaged in the manufacture of ordnance, and he is said to have been the first producer in this country to introduce the ten-hour day. He made it his universal practice never to part with a good workman if he could possibly retain him, and he frequently maintained a large force of mechanics at half-pay when their services were not actually required.

In 1846 the old Alger Forge consisted of a building 70 by 100 feet, equipped with one furnace, five large smithing fires, one vertical hammer, and two horizontal belt hammers, and with a capacity of eleven tons of ship anchors per week.

In March, 1853, when it appeared the facilities were inadequate to the demands, the equipment was materially increased to take care of railroad, steamship and marine work, four steam hammers, a train of rolls, five heating furnaces, five milling fires, etc., constituting the mechanical apparatus, enabling the concern to forge steamboat shafting twenty-four inches in diameter. The forge was capable of turning out at that time one locomotive crank-axle, and twenty-five car axles, or about four tons of forgings per day.

The plant was fitted with four steam hammers, one Hasmyth's Patent, weighing four tons, one Watts' patent of 3,000 pounds, another of the same make of 800 pounds, and one Kirk's patent, of 1,000 pounds.

In July, 1853, the business was sold to Alger & Reed, the former being Francis Alger, a son of the founder, and an eminent scientist and metallurgist, as well as the author of "Alger's Philips' Mineralogy."

His association with the concern was of great significance. Scientifically inclined, he was elected a member of the American Academy of Arts and Sciences, was given an honorary degree by Harvard University, and was often called to Washington by government officials for the purpose of consultations. The inventions and the contributions to the art of metallurgy made by Messrs. Cyrus and Francis Alger were not only invaluable to the United States Government, but they were destined to become the basis of the great advance in that science which continued throughout the latter half of the nineteenth century.

Admiral Dahlgren once said of Cyrus Alger: "He possessed that rare quality, which constitutes the highest attribute of the intellectual man, and that enabled him to arrive at results which others sought by disciplined study, and often in vain." Cyrus Alger died in 1856 and was succeeded in the management by William H. Howard, whose early apprenticeship had been obtained under the master hand of the founder of the business. History has it that during the active years of his life, Cyrus Alger, with Mr. Howard, made the molds and on Saturdays prepared and operated the furnace, the blast of which was driven by horsepower, and that they poured the metal themselves, thus completing the week's work.

In 1862, Francis Alger was granted two patents on improved fuses, and the following year another. During the Civil War the South Boston Iron Company, under which name the enterprise then operated, received many large contracts for projectiles, and early in 1863 an additional foundry, 125 by 114 feet, and a large machine shop, in which were installed three additional 45-ton air furnaces, were built to take care of war orders. Competent judges of conditions at that time stated that had it not been for the South Boston works, and a similar enterprise at Pittsburg, the supply of materials and enginery of war promptly and continuously furnished by these two units, could not otherwise have been secured in the United States within two years.

William P. Hunt, a native of New Hampshire, was long identified with the concern as its treasurer and president, and under his direction guns of the Dahlgren type, invented in 1840 by Admiral Dahlgren, were turned out at the plant just before and during the Civil War.

The eleven-inch guns of the first *Monitor*, which engaged the *Merri-mac*, and the pivots of the *Kearsarge*, which sent the Confederate cruiser *Alabama*, to a watery grave were turned out at the South Boston plant.

About 1855, Thomas Jefferson Rodman, U. S. A., designed the Rodman gun, for land service. It was fabricated of gray iron, but was cooled in casting by means of a tube, through which a stream of cold water continually poured, thus cooling the casting from the center and increasing the density, strength and homogeneous character of the gun. The government tests of these ordnance pieces turned out at the South Boston plant were most exacting, as out of a lot of twenty, one was taken at random and fired 1,000 rounds, with full service charges of powder and solid shot. If the gun stood this test, each of the others was fired with ten service charges, and if intact was passed and accepted. In one instance, a test gun was fired 1,000 rounds and the officer directed that the test be con-

tinued until the gun should burst. After 1,500 rounds had been fired, an additional shot was added to the service charge and then shot after shot was placed until the gun was crammed within a foot of the muzzle, and finally burst, thus showing that something out of the ordinary must be resorted to before the product of the South Boston works would prove a failure.

The leadership of the company in the field of heavy ordnance is illustrated by a report prepared by Mr. Hunt, in which the statement is carried that in 1867 there were shipped to Chile three 1,000-ton cargoes of products within a period of six months, and that there were additional large shipments to Peru and to the Argentine Republic. The work of casting large ordnance continued at the plant, and reports of 45-ton breach-loading rifles are found in the company's archives.

The company's second president, W. H. Howard died in 1875, and for a brief time Edward Reed, of Yarmouth, who had been a director and the treasurer of the corporation, succeeded him, but in 1876, on account of ill-health Mr. Reed resigned. He was succeeded by William P. Hunt.

During the fifteen years previous to his accession to the presidency the South Boston Iron Company delivered 272 Rodman guns to the U. S. Government, of which 103 were of 15-inch caliber.

In 1880, Job Goostray, born near Manchester, England, entered the employ of the company, and it is authentically noted that under James Wood, then foreman of the Ordnance Casting Department of the works, Mr. Goostray fashioned the last of the big guns. He has continued actively in the employ of the concern since that time, as foreman, superintendent, and at the present is retained in a consulting capacity.

At about the same period, Joseph McCreedy, who specialized in air furnace operation and who attained a nation-wide reputation for his marked ability in this line, became identified with the concern, and is still retained as a consultant.

In 1884 a new company was organized and acquired the plant, with Mr. Hunt as its president. It continued to manufacture ordnance and ordnance supplies, such as shot, shells, gun carriages, etc. The slackening demand for ordnance extended the field for the application of the company's famous products to include castings for hydraulic presses, beds for marine and stationary engines, heavy caliber wheels, rolling mill castings, mining machinery, pumping engines, large and small gears, etc. The high tensile strength and tough, wear-resisting properties of the product soon attracted the attention of progressive railroad officials, and with the change from the hook motion to the link motion in locomotives, the use of the company's famous product—air furnace gun iron—was developed for locomotive link blocks, guides, and wheel centers. Castings of these types were supplied to the well-known Hinckley Locomotive works, the Manchester Locomotive Works, and to the railroads in and about the New England states.

Subsequent to 1885 the company contracted with the government for immense gray iron cast rifles, firing 800 pound projectiles, with a service charge of 235 pounds of powder. These were tested over 100 rounds each at Sandy Hook, and in every instance were still serviceable.

The vastly improved quality and cheapness of steel and the adoption of breech-loading guns and high explosives, ultimately necessitated the abandonment of cast-iron, muzzle-loading ordnance.

Later, the South Boston Iron Works designed, manufactured and installed in the U. S. monitor *Terror*, a pneumatic system for moving the turrets, which took up the recoil of the guns placed aboard the vessels, the installation also including apparatus for the hoisting of ammunition and for steering the monitor. This work was highly commended by naval officials when the *Terror* silenced the forts at San Juan, Porto Rico, in 1898, during the Spanish-American War. Mr. Hunt considered this activity the crowning effort of his long and active career with the company, as his designs and apparatus had been bitterly opposed by Navy men on the ground that a contract should not be entered into with a civilian manufacturer not possessing naval training or experience.

In 1892 the plant was moved to 383 Dorchester Avenue, where it operates today.

By 1904, altered conditions of the business had brought the fortunes of the concern to a low ebb and the company was completely reorganized. Walter B. Leach, who had been master mechanic of the Boston & Albany Railroad, at Springfield, was elected treasurer and general manager of the then new Hunt-Spiller Manufacturing Corporation, succeeding later to the office of the president upon the death of William P. Hunt. The new corporation commenced actively to develop the use of Hunt-Spiller air furnace gun iron castings for many of the wearing parts of steam locomotives, for which purpose its product had previously been used to a limited extent.

In the first year of operation the new company melted at a rate which produced approximately three tons per day. This has been increased in the intervening years to several times that quantity. In 1912 and in 1918, and again in 1923, the plant was extensively enlarged, and the modern factory, which exists today on the land to which Mr. Hunt moved his modest little foundry in 1892, has a melting capacity of more than one hundred and fifty tons per day. Up to 1921, the product had been entirely rough castings. In that year, at the insistence of its principal customers, the railroads, the company began to finish some of these castings. This department of the business has rapidly expanded and the concern is now furnishing much finished material. In addition its product enters into many parts of marine engines and also is used for brake drums for trucks and buses.

The service which Mr. Leach had obtained from the high-grade iron supplied the Boston & Albany Railroad during the years he was connected with that system was so extraordinary that he believed it was a material greatly needed in the railroad world to secure the successful performance of locomotives, and he concentrated his efforts along that line, with the result that at the present it is in use on the locomotives of eighty-five per cent of the transportation systems throughout the United States, and on many locomotives operated by railroads in foreign countries.

President Hunt died in 1911, and Mr. Leach was elected president and general manager, which positions he held until his death on March 13, 1928. The qualities in the company's material which had rendered it so eminently fitted for the frictional parts of the modern locomotive suggested its use for similar parts of marine engines and in recent years it has been generally used in the automotive field for brake drums on trucks and buses, due to its splendid resistance to wear and lack of distortion under heat. During the period of plant expansion there has been brought

about a similar development in personnel, the late President Leach establishing stove foundry, engineering, metallurgical and service departments.

That the Hunt-Spiller air furnace gun-iron has continually occupied a foremost position in the locomotive field is attested by the report upon this material carried in the proceedings of the 45th annual convention of the American Railway Master Mechanics Association, held in June, 1912, and again in the 49th annual convention proceedings in June, 1916. This leadership was further evidenced by the fact that during the Government operation of the railroads in the World War period, the Hunt-Spiller air furnace gun-iron was specified as standard on new locomotives in those parts for which it was recommended.

Following the death of President Leach, in 1928, John G. Platt was chosen to succeed him. For many years he had been engaged in railroad operations. He entered the employ of the Hunt-Spiller Manufacturing Corporation in May, 1907, as mechanical representative, was appointed sales manager in June, 1912, and was elected vice president in March, 1917.

Under his administration he has continued to maintain close personal contact with the employees and he has continued the company's policy that has always been paramount to never substitute an inferior product under any consideration. Under his leadership and that of his predecessor, particular stress has been laid upon research and strong and efficient foundry, engineering and metallurgical departments, with modern foundry equipment and metallurgical laboratories contribute to a still higher standard of production, and give the company added prestige and leadership in the railroad and automotive fields.

The corporation has capital of \$1,040,000 and employs upwards of 600 men. John G. Platt is president, Frank M. Weymouth, Frederic Parker and V. W. Ellet, vice presidents, Gordon Dexter, secretary, and F. B. Goff, treasurer.

MANUFACTURES AND INVENTIONS OF THE DECADE BETWEEN 1810 AND 1820

By 1810 the annual exportation of domestic hats amounted to \$100,000, and an officer of one of the hat manufacturing concerns of Boston estimated the production in Massachusetts at that period to be four times in excess of the consumption in that state. About \$3,000,000 were invested in the business at that time, and the Massachusetts production was 1,150,000 annually of \$4 hats, and 400,000 felt hats of \$1 value each. One hat establishment of the period, located on the Charles River, in Boston, manufactured 35,000 hats annually, valued at \$5 each, and employed 150 men.

In 1810, Winslow Lewis was granted a patent on a reflecting and magnifying lantern, adapted to lighthouses, and two years later Congress authorized the purchase of the patent rights, and appropriated \$60,000 to erect lanterns in all government lighthouses.

On July 12, 1810, Phineas Dow of Boston was granted a patent on a machine for splitting leather and on May 18, 1811, Perkins Nichols, another Hub inventor, was given a patent on a rimming augur.

Slade & Whiton erected in 1813 on Hawley Street, Boston, a building containing more than an acre of floor space for the production of coaches, landaus, and chaises, the only pleasure vehicles existing at that period. The concern was among the first to manufacture all parts of a carriage

on the same premises, and among the first to adopt the plan of allowing the front wheels of a vehicle to play under the coach, without elevating the body. They employed sixty hands in the busy seasons.

Walter Frost was one of the pioneer coach builders of Boston and upon his retirement in 1849 he sold the good will of his long-established business to Messrs. Elijah Brigham, Edwin L. Bird, George Smith, and Joshua Mitchell, all of whom had been in his employ for many years. They occupied a three-story brick building 104 feet long and 55 feet wide, at Nos. 9 and 11, Eliot Street, between Washington and Tremont streets, and were the first manufacturers of odometers for coaches, an invention then much sought after by liverymen who were thus able by this device to convince passengers of the distance traveled.

Moses L. Morse was granted a patent on Aug. 22, 1814, on a machine for manufacturing pins of wire in one operation—an ingenious mechanical device, which was used to some extent, but which, on account of its delicacy and intricacy, remained unimproved and fell into disuse when superseded by other machines.

In 1814 the Dedham Manufacturing Company began the manufacture of cotton goods, at Readville, and later the property became a part of the B. B. & R. Knight concern.

THE TOLMAN-FOX CORPORATION

The present-day Tolman-Fox Corporation traces its ancestry to Capt. William Fox, who in 1814, leased a parcel of land, in Woburn, to his son-in-law, Gen. Abijah Thompson, upon which a tannery was erected by the two partners.

When Captain Fox retired about 1830, his son, Warren, carried on the business in the original tannery, and later on Kilby Street, and in 1875, Warren Parker Fox, son of Warren, became the active head of the concern, admitting his son, Everett P. to partnership, in 1885.

Ten years later, the latter assumed the management, and in 1904, his brother, John W. became a member of the firm of W. P. Fox & Sons which tanned exclusively for Locke, Tolman & Co., of Boston.

Everett P. Fox became a partner in the latter concern.

In 1921 Tolman-Dow & Co., acquired W. P. Fox & Sons, Inc., which, in turn was taken over by the Tolman-Fox Corporation, in 1925.

The corporation has sales headquarters in St. Louis, Cincinnati, Rochester, New York, Milwaukee, Philadelphia, Paris, and Melbourne, and its main offices are at 201 South Street, Boston, but its extensive tanneries are located in Woburn.

Gilbert Tolman, Jr., is president, John W. Fox, vice president, Rodney Tolman, secretary, and Everett P. Fox, treasurer of the corporation, which has capital of \$500,000, and employs 250 operatives.

THE STICKNEY & POOR SPICE COMPANY

In 1815 William Stickney began to prepare mustard for the table, grinding it by hand, and marketing his products to his customers in a hand-basket.

Such was the beginning of the internationally known Stickney & Poor Spice Company of today.

In May, 1846, Rufus B. Stickney, son of Wm. Stickney commenced the manufacture of mustard independently of his father, and two years

later he formed a partnership with J. R. Poor, adding the grinding of spices and coffee, as well as the preparation of herbs, yeast powders and sauces to the line of products.

The Stickney & Poor Spice Company has carried on operations continuously for 115 years and today has capital of \$215,000 and employs upwards of 125 operatives. The main headquarters are at 182-184 State Street, Boston, and James S. Murphy is president and treasurer, and Frank W. Tucker, secretary of the corporation, which not only produces spices, but extracts and cream of tartar as well.

SOME INVENTIONS OF THE PERIOD

A new power loom which could be operated either by steam or water, was invented and placed in operation, in Boston, in 1816, by E. Savage, it being adapted for weaving woolen fabrics three yards wide, and the largest sheets without a seam, as well as shirtings, and other cotton goods.

John Adamson of Boston, was granted a patent on December 13, 1816 on a floating dry dock, and on March 24, 1817, John L. Sullivan received a patent on a method of propelling boats by the application of condensed air.

On August 8, 1817, Phineas Dow and Daniel Treadwell were given a patent on the manufacture of screws by a machine, operated by water, steam, or horse-power, which, from a coil of wire, cut, headed, grooved, polished and finished wood screws, at the rate of ten a minute, requiring no manual labor except to coil on a reel, and to apply one end of the wire to the device.

On October 3, 1817, Samuel Rogers and Thomas Blanchard were given a patent on their brad and tack machine, which had been invented by the former, in 1806, at the age of eighteen years, and which had been improved by him while he had been earning the means to introduce it.

Francis Hall, of Charlestown was given a patent on November 28, 1817, on a linen loom, and Moses Hall, of Charlestown, received a grant covering a process of dyeing and polishing morocco, on December 31.

In 1817, Elihu White established the Boston Type Foundry—the oldest unit of its kind in New England.

THE MASON & HAMLIN COMPANY

While America derives many of her industrial adaptations from foreign inventors, the reed which produces a musical tone and which is the basic principle of an organ, is a typical American invention, letters patent therefor having been granted to Aaron Merrill Peasley of Boston, in 1818, the original papers, signed by President James Monroe, and secretary of state John Quincy Adams now being in the possession of the Mason & Hamlin Company of Boston.

It remained, however, for Emmons Hamlin to evolve the art of "voicing" reeds, which, probably more than anything else popularized the reed organ, and associating himself with Henry Mason, son of the distinguished musical composer, Dr. Lowell Mason, the works of the old Mason & Hamlin Organ Company—at one time the largest of their kind in the world,—were erected about 1854, in Boston and Cambridge, with sales-rooms in the former city and in New York and gave employment to 500 hands. Two hundred organs were turned out each week, ranging in price from \$50 to \$500 each, and were shipped not only to domestic buyers,

but to Europe, Western Africa, Japan, China, and Australia, the annual European exportations exceeding \$100,000.

The Mason & Hamlin Company now has capital of \$500,000 and employs 400 operatives in the production of pianos. Henry L. Mason is president, William P. Marsh and Milton Delcamp are vice presidents, H. M. Matteson is secretary, and Paul Quatlander is treasurer.

On April 10, 1819, Robert Graves of Boston, was granted a patent on a machine for the manufacture of cordage, and two years later Winslow Lewis & Co., of Boston, were employing 100 men and boys, and manufactured 746 tons of patent cordage, all of which was produced by the machinery fashioned by Graves.

Daniel Pettibone of Boston was granted a patent, on August 21, 1819, on a process for welding cast steel to iron.

THOMAS C. WALES—"THE RUBBER SHOE MAN"

Massachusetts can justly claim preeminence in the production of commodities manufactured from rubber, for it was a son of the old Bay State who by persistent toil and genius succeeded in converting the treacherous, intractable product known as caoutchouc, or India rubber, into a semi-metal possessed of such rare virtues that it has become the basis of the most important industries in the world.

Crude India rubber was first brought into Salem during the zenith of the shipping days of that port, and in 1820 Para rubber shoes appeared in Boston, while four years later Capt. Benjamin Upton brought to the port of Salem a quantity of the same commodities. The year before 500 pairs of rubber shoes were imported into the Boston market, and in 1825 Thomas C. Wales imported rubber shoes and shortly afterwards sent to Brazil improved forms of lasts which led to the production of better articles of rubber footwear, and to him was shortly accorded the sobriquet of "The Rubber Shoe Man," because it was he who first commercially introduced into the American market the original Para rubber overshoe in its rough, unfinished state, as made by the Indians of that country.

But the port of Salem still led in the importation of Para rubber, more than 40,000 pounds being received in 1828, and from 1820 to 1860 the arrivals of 435 vessels were recorded from Para at that port, and a number of Salem shipping merchants established branch houses in Para.

In 1836-37, 69,822 pairs of rubber shoes and 27,808 pounds of crude rubber were included in the Salem imports; in 1837-38, 97,486 pairs of rubber shoes and 52,325 pounds of crude rubber were brought in by Salem vessels; in 1838-39 only 77,982 pairs of rubber shoes arrived there, and no crude rubber was brought in during those years; in 1839-1840, 3,627 pairs of rubber footwear and 18,048 pounds of crude rubber reached Salem, and in 1840-41, the totals rose to 141,341 pairs of rubber shoes and 49,698 pounds of crude rubber.

The Boston imports ran from 7,654 pairs of rubber shoes in 1836-37 to 80,026, in 1839-40, while the port of New York received 35,561 pairs in 1836-37 and 90,878, in 1840-41, thus indicating that Salem was the big market from 1836 to 1841. All Europe did not receive but 17,942 pairs of Para rubber shoes in 1836-37 and this total fell to 8,870 pairs in 1840-41.

In the twenty-one years from 1836-1856, inclusive, Salem still held her supremacy in the importation of rubber shoes from Para, 1,792,098

pairs being received there during that period, while New York had 1,518,532, Boston, 575,904 and all Europe, 854,741.

In 1850-51 the Salem receipts of crude rubber were 434,000 pounds; in 1851-52, 1,961,000 pounds; in 1852-53, 1,407,000 pounds, and in 1853-1854, 2,056,000 pounds.

The Para rubber overshoe retained possession of the entire market of the U. S. without competition from 1825 to the time when the first "Goodyear Patent Shoe" was manufactured, in Providence, R. I. Even after that, the sales of the "old fashioned rubbers" as they were called, continued to increase. At the suggestion of Mr. Wales the importers of the Para overshoe were advised to send out lasts to the India shoemakers. When, however, Charles Goodyear discovered and perfected the method of producing the vulcanized rubber shoe, its superiority in style and finish and its durability became so manifest that it rapidly superseded all others in public esteem.

THE EARLY RUBBER ENTERPRISES OF BOSTON

In 1832, John Haskins and E. W. Chaffee commenced the manufacture of rubber products at Roxbury, and founded the Roxbury India Rubber Company which was incorporated the following year with an original capital of \$30,000, which was increased in 1834 to \$240,000, and the following year to \$300,000. In 1834 the Boston & Lynn Rubber Company was incorporated, in the latter city, with capital of \$200,000; the Boston Rubber Company was established in Boston with capital of \$100,000, the same year, and three other concerns were incorporated in 1834—The New England Rubber Company with capital of \$70,000, the South Boston Rubber Co. with capital of \$50,000 and the Suffolk Rubber Company capitalized for \$150,000, all these units operating plants in Boston.

Rubber companies were also established at that period in Chelsea, Woburn, and Framingham.

The process originally adopted by these enterprises was not successful. It consisted of dissolving the crude rubber in camphor, or other solvents, mixing lampblack with it, and, while in the form of paste, the composition was spread upon cloth from which garments, shoes and other products were cut and manufactured.

The rubber cloth was next dried in the sun, or in heated rooms, until the solvent was evaporated, leaving the coating of rubber in its natural state. The goods were affected by the heat of summer which caused the product to stick, while in cold weather the product lost its pliability and became stiff and cracked easily. It also decomposed entirely destroying its availability for practical use.

In consequence of these difficulties, all of the companies became insolvent, and the investors lost all the money they had placed in the venture, an amount considerably in excess of \$1,000,000.

The manufacture of rubber products was for the moment temporarily abandoned, and it became evident that unless some radical improvement could be made Para rubber could only be applied to a few uses, and its manufacture would never become of any considerable importance in the industrial life of the country.

It was not until 1838 when Charles Goodyear then living in Roxbury, made his great discovery of the vulcanization of the mysterious liquid flowing from the rubber tree that products permanent in form and use-

ful to mankind could be manufactured and marketed on a successful commercial basis. That year Goodyear received his first patent covering an improvement in manufacturing gum-elastic shoes, and the following year he received another for improvements in the method of preparing caoutchouc, or India rubber, which he assigned to Nathaniel Hayward, of Woburn. Then began the development of the rubber industry of America, and the creation of a plentiful supply of skilled labor in Massachusetts and other parts of New England, which has been augmented as succeeding generations have come along, and which is peculiar to this section in the rubber-footwear field.

THE LESSON TAUGHT BY THE WORLD WAR

It required the World War to convince the rubber manufacturers of the Middle West that Massachusetts and other parts of New England, where rubber footwear had been produced for generations, held the key to the situation, and that the rubber concerns of Ohio could not induce enough of the skilled labor supply to emigrate from here to the Buckeye state to guarantee the permanency of the manufacture of rubber footwear there. Harvey S. Firestone began making rubber shoes in Akron, Ohio, in 1918, but finding it impossible to influence a sufficient number of expert rubber workers to remove from Massachusetts he abandoned the attempt, and in 1922 acquired an interest in the Apsley Rubber Company of Hudson, and eventually the full stock control of that corporation, which now operates as the Firestone Footwear Company. He has since expended upwards of \$1,000,000 in plant extensions at Hudson. In 1929 the Goodrich Rubber Company adopted a similar course, when it acquired the plant of the Hood Rubber Company, Inc., of Watertown, where today all its footwear of the rubber and canvas types are produced.

The early importations of crude rubber from Para to Boston and Salem were primarily responsible for the founding of the American rubber industry in Massachusetts, which today, with its advantageous location to raw materials, its plentiful supply of skilled rubber workers, and its reputation for quality products enables it to experience steady growth and expansion.

In 1927 the rubber concerns located in the Bay State were fifth in rank, being exceeded only by the boot and shoe, cotton, woolen, and electrical industries in the value of the products manufactured.

The Massachusetts manufacturers enjoy the advantage of being nearer to the rubber source of supply than the western group, as practically all the crude rubber used in this country is landed at the ports of Boston and New York. Many of the chemicals used are produced either in Massachusetts or along the Atlantic seaboard, while the second largest raw material item, cotton fabric, is manufactured in both New England and the South. The Goodyear, Firestone and Fisk companies now operate their own tire fabric mills, in Fall River and New Bedford.

One of the measures advocated by Herbert Hoover at the time of the crude rubber crises a few years ago was the increased use of reclaimed rubber where possible without depreciating the quality. This is another branch of rubber manufacturing in which Massachusetts has always led—in fact the first successful process of reclaiming rubber from worn out goods was invented by E. H. Clapp, a Boston man, and put to practical

use in a shop not far from Roxbury Crossing, the business being later transferred to a plant, in Hanover, where operations are carried on today. In 1897 the alkali process, without which tires could not be successfully reclaimed today, was invented in a Cambridge laboratory by A. W. Marks, a young chemist.

MASSACHUSETTS FORGES AHEAD IN RUBBER PRODUCTION

With this background of tradition and long established industry, it may be supposed that Massachusetts has been resting on its laurels and allowing the rest of the country to forge ahead in the rubber field. But the figures prove otherwise.

As recently as 1898 the Messrs. Fisk bought a bankrupt bicycle tire plant, in Chicopee Falls, began business with capital of \$55,000, and within three decades have built the Fisk Rubber Company into the fifth largest rubber producer in the United States.

In Watertown is the largest single rubber footwear plant in the world, and the sixth largest rubber company in the United States—the Hood Rubber Company which did not begin its corporate existence until late in 1896.

The United States Rubber Company—the largest corporation in the rubber industry in the world,—has by far the greater part of its plants in New England, with six of them in Massachusetts—The Revere Rubber Company, in Chelsea; the Boston Rubber Shoe Company in Malden, the American Rubber Company in Cambridge, the Millville Rubber Company and the Woonsocket Rubber Company both in Millville, and the Stoughton Rubber Company in Stoughton. Footwear is produced in the Malden, Millville and Cambridge units; heels, soles and mechanical rubber goods, in the Chelsea plant, and raincoats in the Stoughton and Cambridge units.

The fifth and sixth largest plants, a unit of the second largest and two units of the fourth largest factories of the same company are located in New England, and its other factories in this territory include three in Naugatuck, one each in New Haven and Beacon Falls, Conn., and one in Bristol, R. I.

Despite the fact that the public is wont to think of large rubber companies as being exclusively engaged in the production of tires, Massachusetts boasts of a rubber corporation whose product includes neither tires nor footwear. The Boston Woven Hose & Rubber Company of Cambridge, manufactures mechanical goods, including belting, hose, jar rings, matting, packing, heels and soles, etc., and does an annual business exceeding \$10,000,000, making it the largest company in the mechanical goods field in the country, and the thirteenth largest rubber company in the United States. The corporation operates its own reclaiming plant at Plymouth, and has selling branches all over the world.

Sharing in the effort to reduce the cost of crude rubber by engaging in the reclamation of old products are the E. H. Clapp Rubber Company of Hanover, the Acushnet Process Company of New Bedford, the Appleton Rubber Company, of Franklin and The Stedman Products Company of Braintree, while the rubber insulation of wire is another important branch of the Massachusetts rubber industry and is carried on by the Simplex Wire & Cable Company of Cambridge, the Boston Insulated Wire

& Cable Company of Boston, the Bay State Insulated Wire & Cable Company of Hyde Park, the Gavitt Manufacturing Company, Inc., of Brookfield, The Holyoke Company of Holyoke, the Lowell Insulated Wire Company of Lowell, C. H. McEvoy, of Lowell and Bradford, Kyle & Co., of Plymouth.

Fast growing rubber companies include the Cambridge Rubber Company, of Cambridge, which within recent years has made large extensions to its plant, and whose annual business runs into several millions of dollars; the Tyer Rubber Company of Andover, which within the past five years added footwear to its list of products; the Quabaug Rubber Company of North Brookfield, the Taunton Rubber Company of Taunton, the Panther Rubber Company and the Meade Rubber Company, both of Stoughton, the Archer Rubber Company of Milford, the Converse Rubber Company of Malden, the Plymouth Rubber Company of Canton, Jenkins Brothers of Boston, the Davidson Rubber Company of Charlestown, the Clifton Manufacturing Company of Boston, the F. S. Carr Company of Boston and Framingham, the Hodgman Rubber Company of Framingham, the Easthampton Rubber Thread Company of Easthampton, the Avon Sole Company of Avon, the Foster Rubber Company of Boston, the Frank W. Whitcher Company of Boston, the Lynch Heel Company of Lynn, the Hanover Rubber Company of West Hanover, the Beacon Rubber Company of Lynn, the Brackett Heel Company of Newburyport, the Archer Strauss Rubber Company of Framingham, the Draper Brothers Company of Canton, French & Ward, of West Stoughton, the Reading Rubber Manufacturing Company of Reading, the Stowe & Woodward Company of Newton Upper Falls, and the Alfred Hale Rubber Company of Atlantic, makers of the Rajah moulded and crepe soles, as well as other concerns, whose histories are elsewhere touched upon at length.

F. J. BARNARD & CO., INC.

Historic indeed is F. J. Barnard & Co., Inc., for it was in its former shop at 17 Province Street, that the republican party of Massachusetts was organized, while the concern bound the first copies of Harriet Beecher Stowe's "Uncle Tom's Cabin," as well as Watts' Hymn Book.

In 1821 John G. Roberts founded the enterprise, which at the time was located at 6 Water Street. In 1880, F. J. Barnard and L. M. Pinkham acquired the business from the Roberts heirs and it was then located at 17 Province Street, where operations had been carried on for many decades before.

In 1886, Mr. Pinkham disposed of his interests to Mr. Barnard, and the name of the concern was changed to F. J. Barnard & Co. It was incorporated as such in 1911, and the following year the plant was removed to 105 Federal Street, where it remained until 1922, when it was established at its present location, 368 Congress Street. Up to 1890 it carried on all kinds of book making but for the past forty years it has exclusively devoted its activities to the rebinding of school and library books, in which field it has become a specialist and has acquired an international reputation.

Frank M. Barnard is president and secretary, and E. S. Richardson, treasurer. The corporation has capital of \$50,000, and employs seventy-five operatives.

SOME ENTERPRISES ESTABLISHED BETWEEN 1820 AND 1830

Established in 1821, the Bunker Hill Breweries, of Charlestown, became famous for a century under the regime of the Van Nostrand family, which came of Dutch forbears, but their greatest growth was achieved from 1875 to the advent of national prohibition, under the guidance of Alonzo G. Van Nostrand, of Boston. It was in 1875 that he entered the partnership with his father, and in that year that the world-famous "P. B." trade mark was originated and adopted.

The physical equipment of these breweries was as complete as that of any similar enterprise in the United States, the bottling building alone having a storage capacity of 240,000 bottles. In 1891 the brewing of Bunker Hill lager was begun in a new brewery, and later a \$100,000 brew house was added, until ultimately four acres of floor space were occupied.

THE MANUFACTURE OF SILVERWARE

Boston has long been the seat of silverware manufacture. John Burt, an early Bostonian, is said to have been the first established silversmith in the United States. About 1776 he was succeeded by his apprentice, John Foster, for many years deacon of the Old South Church, and who worked for forty years in a small room in Arm Street, now North Street, which, at that time, was the fashionable part of the city.

Foster melted his silver in a small fireplace with the aid of a common handbellows, and poured it into a small cast-iron skillet, which produced a piece of peculiar shape. From this circumstance was derived the technical word "skillets," afterwards applied by silversmiths to the wedge-shaped silver ingots. The communion service used by the Second Baptist Church, in Baldwin Place, was made by Deacon Foster, without the aid of tools other than an anvil, hammer, and file.

Succeeding these pioneer artisans were Churchill & Treadwell, and Moses Evans, and Hazen Morse, the latter of whom, in 1820, disposed of the business to Lewis Carey, and removed to Haverhill, his native town.

In 1822, Newell Harding, the founder of the celebrated establishment of Newell Harding & Co., began business, having served an apprenticeship with Hazen Morse. Mr. Harding was the first to attempt a division in the trade, and resolved to manufacture only spoons. His success was so great that he soon found an enlargement of his business necessary and in a short time the name of Harding became a household word in the families of New England, as his "stamp" was to be observed upon most of the spoons then in use. He was also the first to introduce power for the rolling of silver. Previously all bars were rolled in a hand "mill," the bar being only wide enough to produce one spoon. He made it possible to produce two or more at a time: The ornamental style of work on spoons then so much in vogue was introduced by him. His son, F. L. Harding, and Messrs. A. H. Lewis and Louis Kimball were later admitted to the firm. The site of the establishment at 12 Court Square, erected in 1836, was occupied as a silversmith's stand for more than seventy-five years and at times the firm employed thirty-five hands.

THE BOSTON CONSOLIDATED GAS COMPANY

In July, 1822, gas-light first flickered faintly forth within the precincts of the new-born City of Boston, which municipality received its charter that year.

The event was duly recorded in the July 15, 1822, issue of the *Boston Daily Advertiser*, in these words:

"Several attempts have been heretofore made to introduce gas lights into this town without success. We are not acquainted with the causes of the failure. An experiment has lately been made with better promise. A company formed for the purpose of furnishing the gas, has succeeded in obtaining that which burns entirely free from smell or smoke, and they offer to furnish it for general use on such terms as will make it the cheapest as well as the most perfect artificial light. They have made a very satisfactory experiment at the shop of Mr. Bacon in Court Street, the splendid appearance of which has nightly attracted much attention. We understand that preparations are making for introducing it into extensive use."

The first local gas works were located in an apothecary shop owned by one Bacon, and located on Court Street, and on August 19, 1822, the aldermen of the city received a petition signed by Alexander Parris and fourteen others, in which the willingness of the authors to produce gas was announced, with a request that authority be granted to lay pipes of a maximum diameter of three inches in the streets of the then youthful municipality.

They also announced a fact which none of the formal historians of the Hub, who assign the installation of the first gas street-lights in Boston to a much later date, ever seem to have noticed. The statement, referring to street lights, is this:

"One of them (opposite the Old Courthouse) is now supplied with the gas and emits a much brighter and clearer flame than any lamp of the same size when fitted with oil of the best quality."

On August 27, 1822, only eight days after receipt of the petition, a special committee reported to the Aldermen that "it will be a great advantage to individuals as well as to the public, if the association can supply the gas lights as they propose," and it recommended, with one or two suitable restrictions, that the petition should be allowed. Accordingly, on the same day, the Aldermen granted to the association the right to lay pipes under the side walks, "provided that the bricks shall be taken up under the supervision of the Commissioners of the Highways and at the expense of the Association."

Thus what today is known as the Boston Consolidated Gas Company was born. On October 31, 1822, the *Boston Messenger* reported that the "City Gas Company have established their works for the making of gas for lighting such parts of the town as can conveniently receive it from the common reservoir," and announced that "the apparatus is nearly completed" and that preparations were being made for laying the cast-iron pipes.

EARLY ATTEMPT TO PRODUCE GAS FROM OIL UNSUCCESSFUL

Unhappily, however, the newspaper reported that the gas to be furnished was to be made from the distillation of oil. In this fact, perhaps

more than any other, lay the cause of the long delay which ensued before there was any actual realization in Boston of the sanguine hopes put forward by the City Gas Company. Although the *Messenger* declared that the advantages of gas made from oil were many and invincible, the truth was that, in those early days, the path of commercial success and practicability lay in the development of gas made from coal and not from oil.

The second important step in the development of the gas enterprise as a corporate undertaking occurred on January 22, 1823, when, upon petition of William Prescott, Alexander Parris, Bryant P. Tilden, Nathan Hale and John C. Gray as incorporators, the General Court passed an act chartering the Boston Gas Light Company, with capital not to exceed \$75,000, and affirming the company's right, with the assent of the mayor and aldermen of Boston, to lay pipes in the street. All of the incorporators, save only Nathan Hale, were members of the group of fifteen who appeared before the Board of Aldermen in 1822 as the City Gas Company or association. To what extent the act of 1823 represented a reorganization of the original enterprise, does not appear. The whole procedure may only have been a recognition of the need of higher legal sanction for so substantial an undertaking as was here involved.

What is entirely certain, however, is the fact that the charter of the Boston Gas Light Company gave rank as a Massachusetts corporation to an organization which, though now re-incorporated as the Boston Consolidated Gas Company, has continued ever since in existence to all commercial intents and purposes, and enjoys the reputation of being not only the oldest gas company in New England but the second oldest enterprise of its kind in the United States. It is equally certain that successful activity on the part of the company did not immediately follow the incorporation in 1823. For one reason or another, but chiefly on account of the impracticability of the plan to use oil as the source of gas supply, no effective measures were taken for the general manufacture and sale of gas in Boston until 1828.

According to Capt. William McKay of the New England Coal & Coke Company, in an article prepared for the *American Gas Light Journal*, in 1917, the first enduring construction of a gas plant in Boston was brought about in 1828 on a plot of land fronting on Hull Street, near the old North Station. The first regularly installed public street lamps were lighted in Dock Square on January 1, 1829, and the illumination was made the occasion of a great public demonstration.

ORIGINAL GASOMETER HAD CAPACITY OF 15,000 FEET

The attempt to use oil as the source of gas supply had been abandoned. *The Boston Almanac* for 1837, describing the gas works then in use, says:

"The gas made at this establishment is a compound of coal and resin, and is esteemed for its brilliancy and illuminating power. There are three gasometers connected with the company's works, two in Hull Street, each of forty feet in diameter, and one in Washington Street, at the extreme south part of the city, of eighty feet. This is the largest gasometer in the United States and contains fifteen thousand feet of gas."

The figures are not only illuminating but amusing when compared with the consumption of gas today. The smallest kitchenette apartment, using gas only for cooking purposes, is likely to consume at least a thousand

cubic feet of gas a month, or one-fifteenth of the total supply offered to the denizens of Boston, in 1837, by the largest gasometer.

When one complains of the high cost of living in this day and generation he need only go back and consult the record to find that the original price of measured gas in Boston was \$5 per 1,000 feet. Today the largest of the Boston company's gasometers holds six million cubic feet, and the total annual sales of gas produced at its plants, in 1928, was 9,563,580,000 cubic feet.

The coal used during the early years of gas manufacture in Boston was from Newcastle, brought all the way across the Atlantic from England. Later, coal from the Albion mines at Pictou and the Lingan mines of Cape Breton was imported. The Pictou coal is known to have been in use here in 1838 and to have formed a part of the local supply from that time forward until 1875. Despite the shipping cost, it could be sold in Boston for not more than \$4.75 a ton. The Cape Breton coal was introduced soon after 1855, and since it was very rich in its yield of gas, it speedily gained wide use. Indeed, so strong was the position of Newcastle and Provincial coals in this market, that it was not until 1850 that any special effort was made on the part of the Pennsylvania coal miners to sell their product along the Atlantic seaboard. "On one occasion," according to J. D. Perkins, of New York, "when the question of imposing a duty on Provincial coal was before a Congressional committee, Mr. W. W. Greenough of the Boston company announced that the legitimate source of supply of coal for New England was from Nova Scotia, and that 'if the Creator had intended my company to use the Pennsylvania coals, He would have placed them East of the Allegheny Mountains!'"

Inevitably, however, domestic coal came to play a larger and larger part in the manufacture of gas in New England, as arrangements for transporting it here by water were improved and as shipment by rail was developed. In 1893, an organized attempt to reestablish Cape Breton coal in its original favor in Boston, met a success so limited as to be tantamount to failure.

THE ADVENT OF THE GAS-METER

If the substitution of coal for oil as the source of gas supply was a fundamental step which had to come before gas could flame forth in Boston as a commercial success, another requisite to the progress of the company here was the advent of the gas-meter. Lacking this appliance, gas was first sold according to the number of burners installed, or at so many dollars per month, according to the size of the pipe which carried the product into the consumer's premises. Neither of these methods proved profitable.

No gas-meters were manufactured in the United States until 1832 and the Boston Meter Works were not organized until 1849. Almost as hot, and more expensive than the flame of gas itself were the controversies and the abuse that centered about the early meters and their alleged inaccuracies before a dependable meter was finally evolved and was later hedged about with the further protection of state inspection laws. Yet even the first crude provision for measuring gas meant the economic salvation of the gas industry, and made possible its establishment on a sound basis.

Up to 1852 the Boston Gas Company was essentially a family concern,

under the management of George Darracott. From 1849 to 1861 the president was Hon. Samuel A. Eliot, formerly mayor of Boston, a member of Congress, and treasurer of Harvard College and the father of Charles W. Eliot, late president-emeritus of Harvard University. Eliot was succeeded as president by John A. Lowell, who served from 1862 to 1877, and whose grandson, A. Lawrence Lowell, is now president of Harvard.

Associated as directors of the company with Messrs. Eliot and Lowell, were Messrs. George W. Lyman, Charles P. Curtis, Augustus Lowell and other equally distinguished men, so that as Captain McKay truly says: "The old Boston Gas Company quite naturally became one of Boston's household *Lares et Penates*, along with Plymouth Rock and the Mayflower."

Successful management of the company through the nineteenth century called for brains and high business capacity as well as for breadth of policy. With the city's growth in population, and with the constantly changing and enlarging needs of local industry, courage and resourcefulness were required to keep the organization abreast of the times.

WHEN COMPETITION THREATENED

The most serious of the scientific questions arose when the process known as the "water-gas process" was introduced—a method which promised an immediate and sizable lowering of production costs. A company styled the Bay State Gas Company, possessing control of a good water-gas process, was organized in Boston, in 1884, under the presidency of J. Edward Addicks.

The older company, having plants chiefly built for the production of coal gas, opposed the new type of manufacture as strongly as possible, and was aided in its opposition, to a considerable extent, by public fear of the higher content of carbon monoxide which water-gas was known to contain. The threat of a sharp competitive struggle between the two companies was, however, averted. The owners of the Bay State Company acquired almost all of the stock of the Boston, Roxbury and South Boston companies, and the Bay State Company, instead of selling its water-gas directly to the consumer, disposed of it to the Roxbury Company, which mixed the product with coal gas, so that the legal limit of carbon monoxide would not be exceeded.

This plan of compounding the product by the use of coal gas is still substantially followed in Boston. Although seventy-five per cent of the existing company's production consists of "steam and oil gas," oil having at last come into its own in the Boston industry, the company still manufactures twenty-five per cent of coal gas. Before being supplied to the consumer, the two kinds of gas are mixed in such a way that the resulting product comprises a better combination of cheapness, illuminating power and safety than could be afforded, in any case, by either water-gas or coal gas alone.

CUTTING THE GORDIAN KNOT OF GAS

If the purchase of the stock of the Boston Company by the Bay State Company offered a satisfactory solution of the difficulty then threatening, the corporate problems of the local industry were still very intricate. Captain McKay's account declares that by 1900 "the ownership and con-

trol of the different companies were so entangled that another Alexander was needed to cut this new Gordian knot. In 1901 the South Boston and Roxbury companies were buying gas from the Bay State Company; the Boston Company was buying gas from the Massachusetts Pipe Line Company; the Dorchester Company was buying from the Pipe Line, the Brookline and the Bay State; the Jamaica Plain Company was buying from the Brookline and the Pipe Line; Dorchester was selling gas to the Roxbury Company; the Boston and Bay State companies were selling to the Brookline Company.

"In 1902 the Massachusetts Gas Company, a voluntary association, was formed to take over the interests of the New England Gas & Coke Company, and in 1903 this new trust also acquired all the interests of the Bay State, Boston, Roxbury and South Boston companies. Thereupon, in June, 1903, an act was passed authorizing the consolidation of the eight companies * * * Renewed public dissatisfaction developed * * * The contest was carried into the Legislature of 1905, and finally, on June 15, 1905, the Boston Consolidated Gas Company became an accomplished fact."

On May 1, 1922, the Boston Consolidated Gas Company acquired by purchase the assets of the Newton & Watertown Gas Company, and of the East Boston Gas Company and on August 1, 1928, it bought the business of the Citizens Gas Light Company, of Quincy.

It now has an average daily output in excess of 26,000,000 cubic feet, is heating over 1,000 homes in the greater Boston district with gas, and is also refrigerating with its product.

One can scarcely appreciate that since so recent a date as 1921, when gas was used for lighting only, the commodity now has over 5,000 uses—a development comparable to the progress of other branches of American industry in that period.

The corporation has its main offices and headquarters in a magnificent modern structure of striking and handsome architectural beauty, at 100 Arlington Street, and the main plant is in Everett.

Under the administration of Dana D. Barnum as president, the concern has attained a wonderful growth. It has capital of \$26,759,600 and employs 2,000 operatives.

Henry S. Lyons is secretary, George M. Cox, treasurer, and A. S. Bull, clerk.

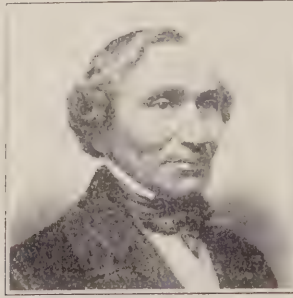
The company has a strong directorate comprising James L. Richards, Charles Francis Adams, Neal Rantoul, J. B. Russell, C. G. Smith, Robert Winsor, Walter C. Baylies, F. E. Snow, E. S. Webster, William A. Wood, Robert Winsor, Jr., Ernest G. Adams, Dana D. Barnum, Allan Forbes, William B. Nichols, and Samuel H. Couch.

CHICKERING & SONS, INC.

At the time when George Washington had just relinquished the presidency and had retired to private life, at Mount Vernon; when Napoleon was at the pinnacle of his power as the dictator of Europe; when George III was trying to console himself for the loss of the American Colonies; in the age when steam power seemed an improbable dream, and the railroad and telegraph were coming events of three or four decades later, there was born in Mason Village, a little town nestling in the hills of the Granite State, Jonas Chickering, whose family shortly thereafter removed

to New Ipswich, N. H., where he became skilled in the trade of a cabinet-maker, but where he gave no local evidence that his name was to become known throughout the civilized world.

New Ipswich possessed one instrumental rarity—a piano made by Christopher Gaynor of London which at one time had been the property of Princess Amelia, the daughter of George III. The old piano became sadly out of order and young Jonas Chickering successfully repaired it,—a remarkable feat for the young cabinetmaker.



JONAS CHICKERING
of Boston

Inventor and manufacturer
of the famous Chickering
piano

But the workman was unsatisfied for there were no more pianos to mend and he had just found his life work. Back to the cabinetmaker's bench he went carrying with him a "divine discontent."

At the age of twenty, he entered the piano-making establishment of John Osborne, of Boston, and within five years had mastered every detail, and had made many improvements of his own.

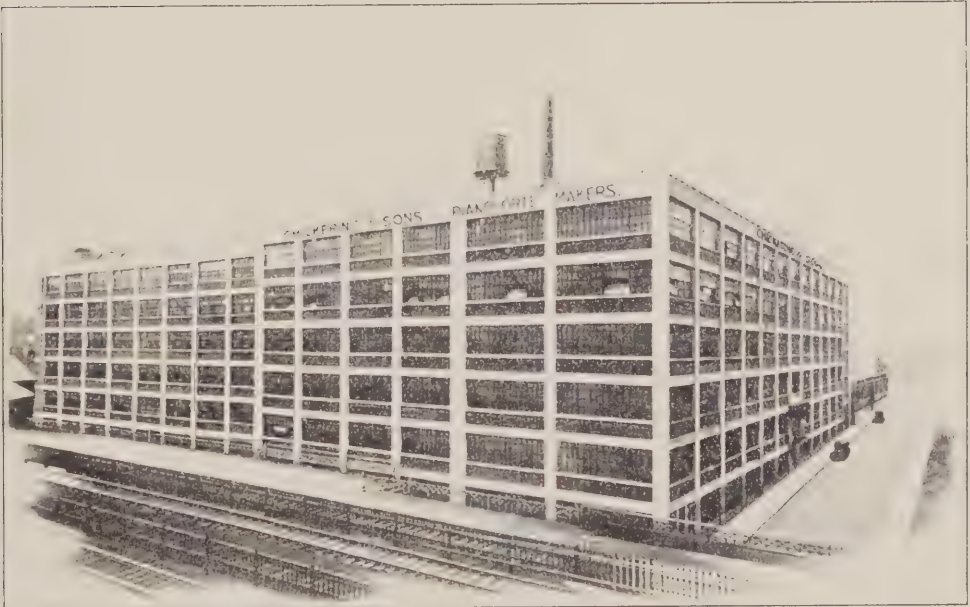
On April 15, 1823, with James Stewart, he established the firm of Stewart & Chickering in a small shop, on Tremont Street, the senior partner soon withdrawing, leaving young Chickering in sole possession.

Not until 1830 did he turn out his first upright, and then he began to dream of the day of the Chickering grand. Associating himself with Capt. John MacKay, master of a sea-going vessel, he shipped to South America his six-octave pianos, and the Captain would return with the hold of his ship laden with rosewood and mahogany for the cases, this arrangement continuing until 1841, when the brave captain went down to the sea in his ship. Mr. Chickering bought the interests of the son of his former associate, and by 1837, he had proceeded far enough with his experiments to overcome the difficulties then inherent in all grand pianos of foreign make. Though his invention of the full iron plate, which was accepted by the scientific world as a device of far-reaching importance Jonas Chickering produced a grand piano which defined a new era in the history of the piano-making art.

In 1843 he invented a new deflection of the strings and two years later he devised and patented the first practical method for over-stringing in square pianos, that is, setting the strings not side by side but in two banks, not only saving space but bringing the powerful bass strings directly over the most resonant part of the sounding-board, a principle



HOME OF CHICKERING & SONS, BOSTON, FROM 1853 TO 1928



CHICKERING & SONS FACTORY, ROXBURY DISTRICT, BOSTON, 1928

which obtains to this day in the construction of all pianos, both grands and uprights.

His contributions completely revolutionized the art of piano manufacture and at the World's Fair, in London, in 1851, Chickering pianos received the highest awards. It was at that period that Mr. Chickering invented piano-making machinery and established one of the first steam mills in the country, sawing his stock by power, and being the first manufacturer to place upon the market pianos equipped with spiral scroll legs.

In 1852, the factory he had erected at 300 Washington Street, Boston, was burned, but, with characteristic energy, Mr. Chickering had plans drawn at once for a new building at 791 Tremont Street, which, from 1854 to 1928, was the seat of manufacture, and which, at the time of its dedication, was the largest structure in the United States, with the exception of the Capitol, at Washington. Five stories in height on the Tremont Street frontage of 245 feet, with wings 262 feet in length, a uniform width of 50 feet, built in the form of a hollow square, and enclosing a spacious court, and equipped with 900 windows, it contained more than 3,000,000 brick, 2,000 perches of stone and 1,605,000 feet of lumber, and was regarded as the most complete manufacturing plant in America.

Jonas Chickering did not live to see this factory completed, for he died suddenly in December, 1853. In his comparatively short life, he had laid the foundation of an industry which was to grow to such proportions that today piano-making is one of the greatest industrial and artistic factors in the nation, and he has been justly called the father of the American piano.

His three sons, Thomas E., Charles F. and George H. who had become members of the firm, upon coming of age, carried on the concern, an immense number of patents accruing to Charles F. Chickering on inventions devised by him. Many new agencies were established, and the art of music was fostered in all its branches.

In 1871, Thomas E. Chickering died, and twenty years later Charles F. died without issue.

George H. Chickering, having no son to succeed him, associated with himself business men and scientific experts who should after his death carry on the business in the interest of his daughters and grandchildren and the daughter, the sole surviving child of his older brother, Thomas Chickering. Ten years after the death of George H., in 1899, the house of Chickering & Sons affiliated itself with other concerns in the formation of the American Piano Company of which it is today a division.

In 1904 Chickering & Sons perfected the quarter grand, said to be the smallest instrument of modern piano construction yet made; in 1911, the concern made it first installation of the Ampico in a Chickering piano and two years later important improvements were effected by it in the construction of upright pianos which increased the volume and enriched the quality of tone. In 1914 a large part of the Boston factory was reconstructed, and in 1916-17 new equipment of every kind was added, while in 1919, signal improvements were effected in the construction of grand pianos by producing a series of new scales, superseding in beauty of tones the grands of previous years.

In 1928 a six-story building, formerly occupied by the Thompson-Crooker Shoe Company and adjoining structures, previously occupied by the Parker Garage were acquired by the American Piano Company and

here production was carried on until the following year when manufacturing operations were transferred to Rochester, N. Y.

The first instrument which came from the hands of Jonas Chickering is now in the possession of Chickering & Sons,—a treasured and carefully protected relic.

The company has been foremost in encouraging musical enterprises of every kind, and has introduced to America a long list of the greatest artists in the world. It has sponsored some of the greatest orchestral and choral works of all time, and has maintained magnificent concert halls in several American cities, which have played a prominent part in developing the musical taste of the people of the United States.

The modern Chickering with the Ampico is a far cry from the little square piano turned out by Jonas Chickering in 1823, but it stands as the supreme expression of present-day science devoted to the art of music, and this twentieth century invention crowns the epoch-making innovation of the man whose devotion to the cause of music in America set new and lofty standards more than a century ago.

President Coolidge (then vice president) speaking at the centennial celebration of the birth of the Chickering piano, held in Symphony Hall, Boston, April 21, 1923, epitomized the influence exerted by the great inventor when, in the peroration of his address, which was broadcast to all parts of the United States, he said: "In the hundred years which have elapsed since Jonas Chickering put the music of his piano into the American home, we have surely outlived the need of propaganda and all artificial stimulus. His genius as an inventor, manufacturer and merchant has had a tremendous influence in giving to the people of our country a musical foundation. He has brought the broadening and humanizing spirit of a great art within the reach of all humanity. He has strengthened the bonds of our common brotherhood, giving a new security to government and increased the power of the people to rule."

BOSTON BUILDS HUNDREDS OF RAILROAD LOCOMOTIVES

The manufacture of flannel had been so stepped up that within forty miles of Boston, in 1824 the existing equipment at that period was capable of producing fifteen thousand 46-yard pieces in a single year.

The Boston & Ipswich Lace Factory, was incorporated, with \$150,000 capital, in 1824, and began the manufacture of lace by machinery.

In 1826, Holmes Hinckley, with a capital of \$250 invested in tools, began fitting up machinery for rope walks, factories, etc., in an old building on Camden Street, Boston Neck, which had previously been used as a stable, and carried the first bars of iron on his shoulders from the store where he purchased them to his place of business. Soon after occupying the building he attempted a stationary steam engine, which, when finished, was the third of its kind built in Massachusetts. During the next fifteen years he had constructed a larger number of engines than any other manufacturer in New England.

In 1840, Mr. Hinckley, in association with Gardner P. Drury, began work on a locomotive upon a model entirely different from any that had previously been operated in this state. Because of its novelty there was difficulty in disposing of it, even at two-thirds of its cost, but finally the Eastern Railroad Company purchased it and it was used for many years by that road. It proved so successful in operation that the builders were

induced to construct six more of the same model, without orders, but before they were completed, they were all contracted for, beside several others of a different model. By 1842, the firm had delivered ten locomotives manufactured by it and from that year until 1848 railroad locomotives were its chief product. On March 13, 1848, the works were incorporated, by act of the Legislature, under the name of the Boston Locomotive Works, with Mr. Hinckley as president and superintendent and the machine shop was extended to a length of more than 400 feet. Hinckley's original capital of \$250, with which he had started in 1826, had risen to \$400,000 by 1848, and between 400 and 500 operatives were regularly employed. The annual capacity of the works in 1855 was between 80 and 100 locomotives a year, and up to August, 1855, there had been turned out by the concern 570 locomotives which were in use on many of the principal railroads of the United States.

Relinquishing the superintendence of the works to younger men, who proved inadequate to the task, Hinckley saw the concern he had reared become hopelessly bankrupt, but, at the age of sixty-six years, he leased the plant from the assignees, and, in 1861, formed the firm of Hinckley, Williams & Co. Business flowing from war activities necessitated large extensions to the plant, and the firm supplied upwards of 50,000 shot and shell, and more than 100 ten and eleven-inch guns to the United States Government. In 1864, the manufacture of locomotives was renewed, an area of five acres being employed. Mr. Hinckley invented a locomotive boiler which effected a great economy in the use of fuel, and before his death in 1866, several hundred additional locomotives had been turned out at the plant.

THE FRANK W. WHITCHER COMPANY AND THE WHITCHER INDUSTRIES

The Frank W. Whitcher Company is one of the oldest concerns of its kind in the United States, the business having been founded in 1826 by John Tillson, but it was not incorporated until 1908.

It controls, either directly or through Frank W. Whitcher, the Chandler Oil Cloth and Buckram Company of Taunton; the Sanitary Welt Insole Company of Boston, the Heaton-Peninsular Button Fastener Company of Boston, the Standard Thermometer Company of Boston, the Mayflower Rubber Works Company of South Braintree, the American Shoe Tip Company of Boston, and the Multi Shoe Cover Company and the M. & T. Button Company, both of Providence, R. I. Tillson began business at 8 Hanover Street, removing to 18 Elm Street in 1828, and to 6 Arm Street the following year. In 1830 he transferred operations to 43 North Market Street, on which thoroughfare the concern remained until 1862.

From 1834 to 1836, after Tillson joined with William Mitchell & Co., and from 1837 to 1842, the firm was known as Tillson & Mitchell. From 1843 to 1847 it operated as William Mitchell & Co., and from the latter year until 1854 as John Tillson & Co. That year the name was changed to Ellison & Arnold, but in 1855 business was again carried on as William Mitchell & Co. Between 1856 and 1882 the firm was variously known as Benjamin Wood, Russell & Phinney, Jos. H. Phinney & Co., Joseph H. Phinney, James P. Phinney, James P. Phinney & Co.

It was on November 11, 1875, that Frank W. Whitcher bought the interest held in the firm by Oscar W. Whitcher, and on October 12, 1882, he began operations under the name of Whitcher Brothers which the next

year was changed to Whitcher & Emery, this title being continued until 1893. On April 1, of that year, Frank W. Whitcher became the sole owner and he operated the business under the name of Frank W. Whitcher & Co., until January 16, 1918, when it was incorporated as the Frank W. Whitcher Company, the corporate name it bears today.

Between 1861 and the present date the concern has operated at various locations on Kilby, High, Kingston, South, Summer, and Albany streets, its present headquarters being on the latter street.

The incorporators were Frank Weston Whitcher, who is president of the corporation and who was the first president of the Massachusetts Chamber of Commerce; Stephen R. Nichols, who is vice president and secretary, and Frederic R. LeGallee, who is treasurer.

Without question the Frank W. Whitcher Company is the oldest shoe findings unit in the United States. Its gradual development covers three distinct periods, the first being as a retailing concern up to 1840, the second as a jobbing house from 1840 to 1872, in which year manufacturing was commenced in a small way, and the third from 1898 to date, during which period it has been exclusively a manufacturing unit.

In the old days most of the findings, and the upper leather particularly, were imported from England and France, but gradually, as manufacturing developed in this country, imported materials were supplanted by those produced in America, and when the shoe factory system began to develop in the period between 1872 and 1885 the concern controlled the patented lasting tools with which all shoes were lasted by hand.

The Crispin jack was the first piece of machinery that was developed and patented to hold shoes while they were being lasted, and following that device came the Knell and Union Lasting Pincers and the Crispin hammers, together with several different kinds of shank lasters, the principal one of which was the Richardson, manufactured by the Whitcher Company. Until lasting machines were introduced all of the shoes manufactured in the United States were lasted with Whitcher tools.

In 1895-96 George E. Downey of the concern introduced the O'Sullivan rubber heel—the first of its kind marketed commercially in a large way,—and in 1898 the Whitcher Company began the manufacture of the Velvet rubber heel, produced with small nail holes. It was at that time that the concern definitely decided to abandon jobbing and to manufacture findings, and since then it has constantly developed plants.

In 1902 a factory was established in Taunton to manufacture Hub tip shoe laces, Victor insoling and box toe material, and seven years later the Heaton-Peninsular Button Fastener Company was organized, as licensor of the button attaching machines used in shoe factories, and it produces the Heaton and the Peninsular button fasteners and tools. In 1914, the development of the company's shoe button plant, now located in Providence, R. I., was commenced, and at about that time the concern acquired the American Shoe Tip Company, makers of copper and leather shoe tips. Later, the Whitcher Company established a plant in Chelsea where mercurized laces are produced.

The extent and ramifications of the enterprises built up by Frank W. Whitcher, who ranks as one of the foremost industrialists of Massachusetts, indicates that he has been creating manufacturing units during the greater part of the twentieth century. The Chandler Oil Cloth & Buckram Company was incorporated in 1902; the Frank W. Whitcher

Company of Boston, Quincy and Chicago, in 1908; the Heaton-Peninsular Button Fastener Company of Boston, in 1909; the American Shoe Tip Company of Quincy, in 1912; the M. & T. Button Company of Providence, R. I., in 1914; the Chandler-Palruba Company of Yardville, N. Y., and the Chandler Oil Cloth Company of East Taunton, both in 1922, and the Standard Thermometer Company of Roxbury, in 1927.

He also sponsored in 1909 the Parker Manufacturing Company of Roxbury; in 1913, the Whitcher Realty Company of Bridgeport, Alabama, and in 1924, the Petrolene Company in Whiting, Ind., all of which are real estate holding corporations. Most of the Whitcher plants are equipped with modern automatic machinery, and employ in the aggregate 375 operatives.

Offices are maintained in Boston and Chicago.

STEPHEN P. RUGGLES—BOSTON'S PROLIFIC INVENTOR

Stephen P. Ruggles, of Boston, was born in Windsor, Vermont, July 4, 1808, and between 1826, when he was but eighteen years of age, and 1868, his name appears on the records of the U. S. Patent Office more frequently than that of any other inventor of printing presses and devices entering into the publishing field.

At Boston, in 1826, he invented and placed in operation, in the printing shop of Putnam & Hunt a new and effective cylinder printing press, which turned out 750 sheets per hour of book work—the first cylinder printing press ever constructed in the United States. The next year he produced a double frisket-bed and platen press, and that same year he invented the first band, or "belt saw" ever known, and operated it in Copeland's machine shop, in Canton.

In 1829 he invented an entirely new and improved ruling-machine for use by copper-plate and steel-plate engravers, and in 1830-31, he invented and built the first card, or job press, which undoubtedly preceded any similar device in the world.

In 1832 he evolved and patented a new and improved method of making stereotype blocks for the use of book printers, and from 1833 to 1838 he was hailed as the father of basic inventions, which to those who then lived in blindness proved to be agencies that opened before them a new world. His power job and card printing presses, his improvement in the form of type, paper, books, maps, slates and writing boards designed for the use of the blind were revolutionary in their nature, and won for him a fame, honor and renown that were bestowed upon him by educational, scientific and philanthropic institutions throughout the United States.

He continued to perfect his early inventions and to create new mechanical devices until 1868.

SOME BOSTON INVENTIONS OF 1826-1828

On March 2, 1826, Daniel Treadwell was granted a patent on a power printing press, one of which was then in operation in the office of the *National Intelligencer*, where it was considered by the proprietors to be the most valuable discovery ever conferred upon the cylindrical principle, adapted to book printing.

In 1827, William S. Pendleton set up in the city the first lithographic establishment in the United States, importing artists and materials from

England to produce portraits, music titles, and other specimens of the lithographic art.

Upon his retirement the establishment passed into the hands of Thomas Moore, who later sold it to B. W. Thayer. The latter disposed of the business about 1855 to S. W. Chandler & Brother who continued to operate it at 204 Washington Street for many years. They made a specialty of lithographic maps, plans of machinery and locomotives, views of public buildings, and every description of labels and enlarged their production to include engraving and designing on copper, steel and wood.

Samuel S. Williams, of Roxbury, was granted a patent on August 22, 1828, on a process for making mats from manilla and other grasses, and on September 23, 1829, J. Rynex, J. Haskins, and S. Knower of Boston were jointly granted a patent on "perpetual water proof boots and shoes."

About 1828, T. Gilbert constructed alone and unaided his first piano and later formed the firm of T. Gilbert & Co., and located at 484 Washington Street with Wm. H. Jameson. From 1836 to 1856 the concern manufactured more than 6,000 pianos, including about two thousand to which were attached Coleman's Patent Aeolian.

BIGELOW, KENNARD & CO.

Just a hundred years ago, in 1830, John Bigelow, a jeweler and watch-maker opened his own store at the corner of Washington and State streets, next to the Old State House, and four years later he admitted his younger brother Alanson, to the firm, which became John Bigelow & Bro.

In 1838, a third brother, A. O. Bigelow joined the partnership, which was changed to Bigelow & Bros. and twenty years later Martin Parry Kennard was admitted, and the firm became Bigelow Bros. & Kennard. Afterwards other partners joined the enterprise and the firm name was changed to Bigelow, Kennard & Co. In 1879 a second Alanson Bigelow was admitted to the partnership, and thirteen years later the third Alanson Bigelow became identified with the house, and today he is the president and managing director of Bigelow, Kennard & Co. The Bigelow family still controls the concern and will take the organization well into its second century of existence.

THE HISTORIC HOUSE OF MARTIN L. HALL COMPANY

One of the oldest houses in the tea and coffee business in Boston, is the Martin L. Hall Company, founded in 1831, as wholesale grocers and continuing as such until December, 1912, when the grocery business was sold and the firm continued in the tea and coffee trade exclusively. In the early years the concern did a large business in Maine and the store was headquarters for vessels in the coasting trade, most of the shipments to the coast towns of the Pine Tree state being made via sailing vessels, and it became the custom of the captains to report at the store when they were ready to take freight.

Martin L. Hall, who retired from the firm in 1872, was succeeded by A. J. Adams and he, in turn, by E. P. Virgin, who died in 1908, in which year the business was incorporated. C. G. Burgess succeeded Mr. Virgin as the senior executive having been connected with the business through all the years following Mr. Hall's retirement.

At the time the house entered the tea and coffee business it moved from

South Market Street, to the present water-front location at 64 Long Wharf, in which it occupies 20,000 square feet of floor space.

The present members of the organization are Charles G. Burgess, president and treasurer; Clarence H. Buker, secretary and manager, and Herman M. Metcalf, director, the latter being in charge of the tea department. Mr. Buker became associated with the company as manager of the coffee department in 1903, when he resigned from the Boston office of Hard & Rand, Inc., and he developed that branch to a point where the business could be profitably conducted on a specialty coffee and tea basis. Mr. Metcalf has been with the concern since 1879, progressing through various departments inside and as salesman in Boston and vicinity to his present position.

Several members now holding positions have been connected with the organization for over thirty years and the company is represented by some twenty-five salesmen throughout New England, New York, Pennsylvania, the South and the Middle West, handling a number of well-known package brands of both coffee and tea in addition to the thriving bulk business.

A plant, well equipped with modern milling, separating, roasting and packing machinery, abundant storage space and an up-to-date printing department of cylinder and job presses, places the Martin L. Hall Company in a position to receive its full share of business in all territories. The corporation has capital of \$135,000.

THE OLIVER DITSON COMPANY

In the year 1811, notable for the births of Thackeray and Liszt, Charles Sumner and Harriet Beecher Stowe, and the year antedating the advent of Chopin, Schumann and Ole Bull, there was born near Copp's Hill, in Boston, Oliver Ditson destined to found America's oldest music publishing enterprise. At twelve years of age, young Ditson entered the employ of Samuel H. Parker, where he remained for three years, when he left to apprentice himself to Isaac R. Batts, then engaged in printing *The North American Review*, and later he worked for Alfred Mudge. In 1835, at the age of twenty-four, he began business for himself at 107 Washington Street, being organist and choir master of the Bulfinch Street Church, at that time. So rapid was his progress as a music publisher, that his former employer, Samuel H. Parker, decided that the only way to solve the problem of competition was to make Ditson his partner, which he did on April 5, 1836, ten months after the young man had copyrighted his first musical publication.

The growing business of the firm led the partners to locate in the old gambrel-roofed building that had stood on the site of the home of Anne Hutchinson, the first woman champion of intellectual freedom in America, since 1712, and where books were sold continuously from 1828 to July, 1903.

In 1842, Oliver Ditson purchased his partner's interest and two years later moved from the Old Corner Book Store location to 115 Washington Street. In 1845, John C. Haynes, then a boy of fifteen, entered Mr. Ditson's employ at the weekly stipend of \$1.50, and eight years later his value was recognized by giving him an interest in the business, while on January 1, 1857, he was admitted to partnership and the name of the concern was changed to Oliver Ditson & Co. That year the senior partner

erected, for the occupancy of the firm, the building at 277, now 451 Washington Street. In 1858 *Dwight's Journal of Music* was acquired by the firm, which continued to publish it until the end of 1878, when it was sold.

In 1860 Mr. Ditson established John Church, a young man who had been in his employ from boyhood, in Cincinnati, and eleven years later the business was sold to Mr. Church, and is well-known as The John Church Company.

In 1864 Mr. Ditson employed some of his capital in establishing two young men—P. L. Healy and George W. Lyon,—in Chicago, under the time-honored name of Lyon & Healy, and on March 4, 1867, Oliver Ditson & Co., purchased the music plates, stock and good-will of Firth, Son & Co., of New York City, which led to the establishment of a branch house in the metropolis, under the management of the founder's eldest son, Charles H., and bearing the title of Charles H. Ditson & Co. The original location was at 563 Broadway, but shortly after larger quarters were taken at 711 Broadway, and when the music catalog and business of Wm. Hall and Son, and of J. L. Peters, both of New York, were purchased by Oliver Ditson & Co., in 1875 and 1877, respectively, the firm removed to 843 Broadway, in 1878, where more area was available.

In 1875, the purchase of the catalog of Lee & Walker, of Philadelphia, led to the opening of a branch house in that city, under the management of another son, James E. Ditson, and which was operated as J. E. Ditson & Co. Four years later, the stock and music plates of G. Andre & Co., of Philadelphia, were purchased, and in 1881, the business was removed from 922 to 1228 Chestnut Street. That year, J. E. Ditson died.

In 1883, the Ditson Building was erected at Broadway and 18th Street, New York City, where the firm remained until it built its new structure, at 8-12 East 34th Street, in 1907.

In 1890, the entire catalog, stock and music plates of F. A. North & Co., of Philadelphia, were purchased.

Meantime the expanding business of the Boston house, which, in 1877, had purchased the catalog and good-will of G. D. Russell & Co., compelled the occupancy of the adjoining store at 449 Washington Street, which had been erected as an addition to No. 451.

Following the sale of *Dwight's Journal of Music*, Oliver Ditson & Co., established the *Monthly Musical Record*, which in 1898 became the *Musical Record*, and that year the firm began the publication of a pocket-size monthly magazine under the name of *Musical Review*, which bulletined the company's publication, and three years later this was combined with the other publication under the name of *Musical Record and Review*. Two years later, *The Musician*, published by the Hatch Music Company of Philadelphia, was purchased, the smaller magazine was dropped and the new publication in its present form has been issued since.

Oliver Ditson died on December 21, 1888, at the ripe age of seventy-seven years, and the surviving partners—John C. Haynes, and Charles H. Ditson, with the executors of Oliver Ditson's will,—organized the Oliver Ditson Company, with Mr. Haynes as president.

In 1891 when larger quarters were needed, the Dexter Building, at 453-463 Washington Street, was leased and occupied until 1901, when a modern ten-story structure at 451 Washington Street, erected by Charles H. Ditson on the site of the five-story building his father had constructed in 1857, became the home of the Oliver Ditson Company for three years,

when a new structure built for the special needs of the corporation, at 150 Tremont Street, and facing Boston Common, was occupied. Upon the death of President Haynes on May 3, 1907, after sixty-two years connection with the enterprise, the presidency and the direction of its great interests devolved upon the son of the founder, Charles Healy Ditson.

In 1917 the building erected sixteen years before was found to be inadequate to the company's needs and a magnificent ten-story structure was built at 178-179 Tremont Street, which is now occupied by the corporation.

Charles H. Ditson is president, William Arms Fisher, vice president and publishing manager and Edward W. Briggs, secretary and treasurer.

This oldest music-publishing house in America, now nearing its centennial anniversary, has capital of \$500,000.

SOME BOSTON ENTERPRISES FORMED IN THE THIRTIES

At a time when there were not more than three saw manufacturers in the country, Charles Griffiths, who had been engaged in that trade in Great Britain, came to Boston, and, in 1830, joined with William Welch, in establishing Welch & Griffiths' Saw Manufactory.



CHARLES GRIFFITHS
of Boston

Founder of Welch & Griffiths Saw Manufactory of that city, formed in 1830

Griffiths was the inventor of machinery patented by him for grinding both surfaces of a saw simultaneously, with accuracy and precision.

Like many another American concern the firm met with strenuous opposition for some years, as the trade held strong prejudices against saws made in this country, claiming that they were inferior to the imported product, but within a generation the Welch & Griffiths organization became celebrated from the Atlantic to the Pacific for its products.

In 1833, a German emigrant named La Founte began the manufacture of silverware in Boston, on a small scale. He was succeeded by his two sons, under the firm name of F. J. La Founte & Co., the plant being located on Water Street. They made a specialty of urns, vases, pitchers, tea sets and other wares for domestic use.

Samuel Batchelder of Boston, contributed to cotton manufacturing several important inventions, producing and applying, in 1833, the first stop motion to the drawing frame which was subsequently patented in England, and he invented, in 1835, the steam cylinders and connections,

which became universally used in dressing frames for drying yarns. Perhaps his greatest invention was the dynamometer, for ascertaining the power for driving machinery, and first used in the York mills in 1837.

Edwin M. Chaffee, of Roxbury was granted a patent on May 17, 1834, on a process for making boots and shoes from India rubber.

In 1835 the Massachusetts Silk Company was incorporated with capital of \$100,000 to engage in the manufacture of silk.

Messrs. Farrington & Hunnewell began the manufacture of silver table-ware in Boston, in 1835, and employed fifty men, the firm being the first to introduce "rolled work."

THE BOSTON WHARF COMPANY

Those who delight in poking fun at Boston by asserting that her citizens have not entertained a new idea in a hundred years might well pattern after the example of a group of optimistic citizens of the Hub, who, less than a century ago—in 1836, to be exact—organized the Boston Wharf Company which corporation today owns enough industrial and commercial buildings on the harbor front to count one for each of the ninety odd years of its existence, and is laying plans to erect new structures to accommodate the constantly growing demand.

But the interesting part of this experiment is that in 1836 there was not a square foot of land available upon which to place the corner-stone of a single structure today owned by the company. The terrain on which they now stand did not then exist. It has been produced by the filling process, and what, less than 100 years ago, was a part of the Atlantic Ocean is today the locale of real estate holdings upon which the company is assessed for more than \$11,000,000 for municipal taxation purposes. In the language of the street, let the critics "laugh that one off."

By special act of the Massachusetts Legislature the company was chartered and its rights were extended by successive grants, which were sharply contested at the time and finally settled by a Supreme Court decree. This pooling of the riparian rights of several South Boston and owners has resulted in a phenomenal industrial development perhaps unequaled in a comparable area anywhere else in the country. Gradually, the filling was done from 1836 to 1872, when the great Boston fire occurred, and which proved, at least in this instance, a blessing, rather than a catastrophe, as the Wharf Company threw open its premises without reserve to receive the debris taken from the ruins of the hundreds of buildings that were destroyed.

As the site became filled a bulkhead, wharves and sheds were built and for many years a prosperous business was done by the company in handling and storing cargoes of sugar and molasses. One of the corporation's executives recalls the fact that in 1870 there were no less than sixty-four brigs and schooners tied up to the company's wharves at one time.

At times the Wharf Company had 20,000 hogsheads of molasses in storage, which had been brought to its piers by the vessels traversing the lane between Boston and the West Indies, but the organization of the so-called sugar trust, and tariff changes which eliminated differentials previously allowed on molasses, practically destroyed this business, and after 1877 dividends were suspended, and the outlook for the Wharf Company appeared gloomy indeed.

But in 1882 the previous policy was completely reversed, resulting in virtually abandoning the wharfage and storage activities and inaugurating a systematic and thorough development of the entire property, until today only about one-fourth of the total area embraced in the company's holdings is still open, and from that year the corporation eventually became a real estate proposition. Since then it has maintained an unbroken dividend policy. In 1885 it collected \$2,500, in rents; in 1925, about \$750,000. In 1885 the population in the vicinity of its holdings was less than 300; in 1925, it was more than 10,000. In 1885, there were no buildings on the property, other than the sugar sheds. Today, there are upwards of ninety structures, most of them of heavy mill construction. The buildings are along streets practically all owned by the company, and with ample railroad facilities and spur tracks of the New Haven system. Among the company's early industrial tenants, some of whom have been occupants for years and hold high rank among Massachusetts manufacturers are C. L. Hauthaway & Sons, Lombard & Co., F. S. Webster & Co., American Radiator Company, Brown, Durrell & Co., Pittsburgh Plate Glass Company, National Lead Company, Jones, McDuffee & Stratton Company, most of whom are occupying buildings. Hauthaway & Sons were the earliest tenants, having rented quarters in 1887. Later leases include The Ginter Company, Dwinell-Wright Company, John T. Connor Company, Cudahy Packing Company, Corn Products Company, Armour Leather Company, Howes Bros., George E. Keith Company, United States Leather Company, Crucible Steel Company, Fairbanks Company, A. C. Harvey Company, Edgar T. Ward's Sons Company, American Can Company, J. I. Case Threshing Machine Company, General Electric Company, Westinghouse Electric & Manufacturing Company, United States Radiator Corporation and many others. Frequently buildings have been built for tenants and this custom still is being followed.

In 1902 and 1906 eight large buildings were erected for the New England Confectionery Company, which concern occupied them until it removed to its magnificent new plant in Cambridge, in 1927—the largest candy factory in the world.

As "landlord" to numerous important manufacturing and industrial concerns the Boston Wharf Company has served the City of Boston and the Commonwealth of Massachusetts faithfully for many years and promises in the future to even further increase its worth-while work.

THE D. & L. SLADE COMPANY

In 1837, Henry Slade began the operation of a tide mill, which had been created under an original grant of the selectmen of Boston, in 1721, located on the creek between Chelsea and Revere, adjoining the present Revere Beach Parkway, and which is now in daily operation, the present plant having been in continuous use for upwards of one hundred years. It is popularly supposed to be not only the oldest, but the only mill of its kind in this section of the United States, devoted to industrial purposes.

Originally it was used for grinding corn, and later for snuff, while today it is devoted to the preparation of spices by the D. & L. Slade Company.

Under the old grant the people of Rumney Marsh, then a part of Bos-

ton, but now the City of Chelsea, were permitted to erect a dam and tide mill, and the latter was built in 1734.

For nearly 200 years, except for interruptions by fire, a tide mill has been maintained on the site.

Following a fire in 1816 the townspeople petitioned the General Court for authority to rebuild the mill and the dam across the creek. The right was granted, but a provision was placed in the charter, which operates to this day, to the effect that the mill must at all times hold itself in readiness to grind corn for any citizen of Chelsea, provided that the corn was raised there.

In the old days the mill was a clearing house where farmers transacted much of their business and exchanged their wares and traded their corn for tobacco, wool and other commodities.

In 1837, when Henry Slade acquired title to the mill, his two sons conceived the idea of grinding spices by power. Up to that period housewives had been obliged to prepare their own spices by hand.

The two boys, D. and L. Slade, ground half a barrel of cinnamon, and placing the commodity on two poles walked to Boston, where they speedily sold it to local merchants. Such was the local beginning, not only of spice grinding, but of a large and flourishing business in spices and grocers' specialties, which today employs upwards of sixty operatives, has capital of \$200,000, and markets its commodities throughout the United States and foreign countries. Every business day of the year, the old mill on the creek depends upon the incoming and outgoing tides of the Atlantic to propel it. H. S. Milton is president, Norman S. Dillingham, treasurer and Robert F. Fitz, secretary of the D. & L. Slade Company.

LOOKING BACKWARD NEARLY A CENTURY

In 1839, A. A. Hayes, of Boston, was granted a patent on a process of extracting tannin from astringent barks and the same year Cyrus Alger was awarded a patent covering an improvement in the manufacture of cast-iron ploughs, while George S. Griggs of Roxbury, received a patent on a self-acting brake for railroad cars.

Turning back the pages of history a hundred years one finds a lead paint factory, a chain cable plant, Jonas Chickering's piano enterprise and William S. Pendleton's pioneer lithographic establishment,—the first in the United States—constituting the major manufacturing enterprises of Boston, but in the decade between 1830 and 1840 Griffiths & Welch began the production of circular saws; six flint-glass furnaces, two producing \$400,000 worth of cut-glass, were placed in operation; the Roxbury, Suffolk, South Boston, and other India-rubber companies were coming into being; the East Boston Sugar Refinery was established; the Fulton Foundry Company was incorporated; the Adams Printing-Press Works began business at South Boston; Coney's Iron Foundry commenced production and the Boyden Malleable Iron & Steel Company was formed.

The Dickinson Type Foundry was established in 1840 by S. N. Dickinson, a distinguished printer, and the originator, and for many years the proprietor of the famous "*Boston Almanac*." In his work as a type-founder, he was the first to introduce into the United States the modern "Scotch-cut letter," so highly appreciated by the printing trade the middle of the last century.

SAMUEL F. B. MORSE—THE INVENTOR OF THE TELEGRAPH

Less than a year following the death of Benjamin Franklin, and but a little more than a mile distant from his birthplace, there was ushered into the world, in 1791, in a modest home at the foot of Breed's Hill, in Charlestown, Massachusetts, a babe destined to gain the honor before he reached his fiftieth birthday of receiving a patent covering the first major practical application of electricity in the world—the invention of the telegraph.

With the exception of the isolated work of Franklin, the development of the new science of electrical art was the work of Europeans, and yet with all the attributes of accumulated wealth and learning attained by older civilizations, it remained for the youthful and immature American republic to recognize the latent possibilities of this new force, to harness it for the service of humankind, and to apply practical genius and business ability by providing a workable system of rapid and certain electrical communication.

Up to the time Samuel Finley Breeze Morse, produced the telegraph instrument, electricity had remained largely a scientific toy.

Coming from the sturdiest of Puritan stock, of English descent on the paternal, and of Scotch heritage on the maternal side, young Morse, at the age of seven years, was sent to a school in Andover to prepare himself for Phillips Academy, from which institution he went to Yale. There he sat under Jeremiah Day, professor of natural philosophy, and undoubtedly America's ablest exponent of that subject, at that period, and whose lectures and demonstrations upon electricity aroused the interest of his student, as is evidenced by the letters written by young Morse to his parents.

He was particularly impressed with one principle enunciated in a text-book, then in use at Yale, which stated that "if the electric current be interrupted at any place the fluid will become visible, and when it passes it will leave an impression upon any intermediate body." More than a score of years after Morse had invented the telegraph, he wrote: "The fact that the presence of electricity can be made visible in any desired part of the circuit was the crude seed which took root in my mind, and grew into form, and ripened into the invention of the telegraph."

Although Yale College was the center of scientific activity in 1810, when Morse was graduated, and despite the fact that he showed more than ordinary interest in electricity and chemistry, his major bent remained in the field of art. As a boy of fifteen, he had painted water-colors that attracted attention, and his talent in producing miniatures which he sold for five dollars each, while a college student, enabled him to aid in defraying his scholastic expenses.

Becoming the pupil of Washington Allston, then one of the foremost of American painters, he sailed with his teacher for England, in 1811, where the attention of Benjamin West, then at the height of his career, was drawn to the young man, who was much benefited by West's advice and encouragement.

Remaining abroad for four years, he returned to America to gain fame, praise and attention for the artistic products of his brushes, but not fortune, and he was forced to eke out a precarious existence by paint-

ing an occasional portrait and in going from town to town as an itinerant artist in search of subjects.

For a time he turned from art to the field of invention, and, with his brother, evolved a fire-engine pump of an improved pattern, which they patented, but could not sell. Turning again to the life of a wandering portrait painter, he went to South Carolina in 1818 at the invitation of an uncle, where his portraits proved popular. Four years later he came north and devoted his time to huge historical paintings, which the public would neither buy nor pay to view while on exhibition.

MORSE CONCEIVES THE BASIC IDEA OF THE TELEGRAPH WHILE AT SEA

In 1829 he again went to Europe and spent three years in study in the galleries of Paris and Rome and singularly enough it was on the packet ship *Sully*, on his return from France, that Samuel F. B. Morse conceived the telegraph.

One noon, when the passengers gathered at the table, Dr. Charles T. Jackson, of Boston, exhibited an electro-magnet he had purchased in Paris, and described some electrical experiments he had witnessed while there. Asked by one of the interested passengers at what speed electricity passed through a wire, Jackson replied that, according to Faraday, it was practically instantaneous.

This discussion recalled to Morse his studies in electricity at Yale and he remarked that if the circuit were interrupted the current became visible, and that it had occurred to him that these flashes might be used as a means of communication. This idea of utilizing the electric current to carry messages became fixed in his mind, and during the remaining weeks of the long, tedious voyage he pondered deeply as to how the mysterious agency might be harnessed. He set himself to work on the task of finding a means by which he might make the current not only signal a message, but actually record it, and before the *Sully* reached port, he had worked out sketches of a printing telegraph, with the current actuating an electro-magnet, on the end of which was a rod that marked dots and dashes on a moving tape of paper.

Thus was the idea born in the mind of Morse, but the telegraph was far from an accomplished fact. Lacking improved electro-magnets and Professor Henry's relay, Morse had not at that period even approached the basic ideas upon which the invention could operate over considerable distances, but he eagerly began work to attain practical results.

As he left the *Sully*, on arrival at New York, he said to the master of the ship: "Well, Captain, should you hear of the telegraph one of these days as the wonder of the world, remember that the discovery was made on board the good ship *Sully*."

Poverty still attended him and he was forced to devote most of his time to painting, in order to secure funds for living expenses and the means to purchase materials for experimental purposes, but from 1832 to 1835 Morse was able to make but little progress.

MORSE BECOMES A COLLEGE PROFESSOR

In the latter year he was appointed as professor in the then recently established University of the City of New York and setting up his crude apparatus in a room at that institution, he was able to transmit messages in 1835. With more financial means and some leisure time, coupled with

the assistance of Professor Gale, a teacher of chemistry, whom Morse accepted as a partner in the enterprise, he continued to make progress on the invention. The original electro-magnet used by Morse in the experimental set carried but a few turns of thick wire, and he adopted Professor Henry's plan, used in the latter's experiments of five years before, of employing many turns of small wire, which rendered the electro-magnet far more sensitive. Henry had devised receiving apparatus similar to that created by Morse and by which he signaled through a mile of wire, but in the Henry invention the armature of the electro-magnet struck a bell, causing the messages to be read by sound, rather than being recorded on a moving strip of paper as in the case of Morse's model.

Professor Henry realized, in common with Morse and others, that if the current were to be conducted over wires operating at long distances it would become so weak that it would fail to operate a receiver, and he avoided this difficulty by inventing the relay. This piece of apparatus was found to move a delicate electro-magnet with a very light armature so arranged as to open and close a local circuit equipped with suitable batteries, and it successfully overcame the difficulties inherent to wire resistance and to losses due to faulty insulation. Thus the recording instrument could be placed on the local circuit and as this was opened and closed in unison with the main circuit, the receiver was successfully operated, and Henry's relay made it possible to extend telegraph lines to a considerable distance.

ACTION BY CONGRESS SPURS MORSE ON

By 1837, the latter had improved his apparatus, installed more powerful batteries, and longer wires, and had mastered the use of the relay. It was in that year that the House of Representatives, at Washington, ordered the Secretary of the Treasury to investigate the feasibility of establishing a telegraph system, a factor which spurred Morse on to the development of a new model.

It should be recalled by the reader that while today an inventor may purchase wire, springs, insulators, batteries and practically everything identified with the electrical world, conditions in 1837 were far different from those of 1929. It was exceedingly difficult to secure materials and devices such as Morse needed, and even when they were available the prices were almost prohibitive. Scientific knowledge of electricity was largely theoretical at that time, and Morse, with scanty funds and only a few idle hours at his command, was forced to search for materials and puzzle his way out of the maze with such crude tools and supplies as were available.

Almost out of a clear sky on a Saturday during the month of September, 1837, a young man wandered into Professor Gale's laboratory, where Morse was engaged in exhibiting his latest model to an English professor then visiting in New York. The youth was deeply impressed with what he saw, and at once realized that the invention held the possibilities of becoming an instrument that would be of untold service to mankind.

Inquiring of Morse whether he intended to experiment with a longer line of wire, he was informed that such would be his program just as soon as he could secure the financial means, whereupon the visitor replied that he believed he could secure the money if Morse would admit him as a partner, to which the inventor promptly assented.

It is a peculiar coincidence that the family name of this youthful financial angel should have been the same as that of the distinguished business administrator who forty years later was called upon by Gardiner Greene Hubbard, Thomas Sanders and Alexander Graham Bell to bring order out of chaos in the development and commercialization of the telephone, and that the Vails should thus have become identified with the two greatest inventions of the nineteenth century—the telegraph and the telephone.

THE ASSISTANCE RENDERED BY ALFRED VAIL

Young Alfred Vail plunged into the movement to make the telegraph practical with all the enthusiasm of youth, and before he retired that eventful Saturday night he had studied the commercial possibilities of the invention and had traced on maps in an atlas the routes of the most advantageous lines of communication. His father, the head of the Speedwell Iron Works, of Morristown, N. J., a man of unusual business ability and enterprise, at once determined to back his son in the enterprise and invited Morse to come to his home and exhibit his model, which he did. On September 23, 1837, an agreement was executed by the terms of which Alfred Vail was, at his own expense, to construct apparatus suitable for exhibition to Congress; to secure a patent, and to be given a one-fourth interest in the invention, it being estimated by Morse that \$2,000 would be necessary to build the required instruments and to care for the patent applications. Shortly afterwards a caveat was filed in the U. S. Patent Office, thus protecting the impending invention.

Young Vail immediately began work on the apparatus with William Baxter, a fifteen-years-old apprentice, both of whom worked early and late for many months in a secret room at the iron works, where they fashioned every part of the model.

The first machine was a replica of Morse's model, but the native mechanical ability and ingenuity of young Vail enabled him to make many improvements, including the substitution of a fountain pen which inscribed long and short lines for the pencil which Morse had fastened to the armature and which had marked zigzag lines on the moving paper.

Thus the dashes and dots of the Morse code were placed in their present form. The inventor had evolved an elaborate telegraphic code or dictionary, but Vail recognized the importance of devising the simplest possible combination of dots and dashes for the most used letters of the alphabet, in order to increase the speed in transmitting messages. He set to work to figure out the frequency with which the letters occur in the English language, and it dawned on him that the combination of types in a type-case would be an excellent guide. Visiting a local printing shop, he found the result worked out for him, and by observing the number of types of each letter, he was enabled to arrange them in the order of their importance in assigning them symbols in the code.

Alfred Vail played a very important role in the arrangement ultimately employed and many of his contemporaries felt that the code adopted should have borne his name, rather than that of Morse.

The latter frequently went to Speedwell to assist Vail and Baxter, and early in January, 1838, the telegraph was at work. The senior Vail was called to the work shop. His son was at the sending key, with Morse at

the receiver. The father wrote on a piece of paper: "A patient waiter is no loser."

Handing the message to his son he remarked that if he could transmit it to Morse by the telegraph he would be convinced that the apparatus was practical.

It was sent, recorded, and instantly read by Morse. The first test had been completed successfully, but the great task of introducing the invention to the public, of overcoming skepticism and indifference, and of securing financial support sufficient to build a telegraph line, remained to be accomplished.

MORSE ENLISTS CONGRESSIONAL SUPPORT

This burden fell upon Morse's rugged shoulders and had he not been a forceful and able man of affairs, as well as an inventive genius, the introduction of the telegraph might well have been even longer delayed.

The invention was publicly shown in New York and Philadelphia where it was regarded as a scientific plaything, rather than as a practical possibility. Morse next took his model to Washington, D. C., and installed it in the room occupied by the House Committee on Commerce, in the Capitol. Finally a convert was made in the person of Hon. Francis O. J. Smith, Chairman of the Committee before whom Morse had urged the propriety of the U. S. Government owning, controlling, and operating the telegraph in behalf of the public welfare. This proposition carried little or no appeal to the solons, whereupon Morse suggested that Congress should be sufficiently interested to provide funds to build an experimental line 100 miles in length, in return for which he was willing to promise the U. S. Government the first rights to purchase the invention at a reasonable figure. Later he changed his request to a line fifty miles in length, which he estimated could be installed for \$26,000.

In February, 1838, Smith secured the attendance of all members of his committee and a test was made over ten miles of wire, the demonstration convincing the group that the invention was sound and practical. The committee immediately reported a bill appropriating \$30,000 to build an experimental line between Washington and Baltimore, and Chairman Smith became so enthusiastic over the invention that he sought a share in the enterprise, and, securing it, resigned as a member of the House of Representatives, to act as legal adviser and to devote his efforts to securing the passage of the measure.

A company was formed to exploit the telegraph, with sixteen shares, of which Morse held nine—the controlling interest—Smith, four, Alfred Vail two, and Professor Gale, one.

Morse was anxious to protect his invention abroad, and accompanied by Smith, he sailed for England in May, carrying with him a new instrument built by Vail. Reaching London, they applied for a patent, were opposed by Wheatstone and his associates, and could not secure a hearing by the patent authorities. With no recourse left save an appeal to Parliament,—a long and expensive proceeding with little apparent possibility of success,—Morse went to France, where experts examined the apparatus, witnessed tests, pronounced his invention the best that had been devised, and granted him a patent, which, however, was of no avail inasmuch as under the provisions of the French law a patent in order to be effective must be placed in operation in that country within two years.

Faring no better with other European governments, Morse returned to this country to push the Congressional measure, only to find that Dr. Jackson, his fellow-passenger on the *Sully* had muddled the situation by laying claim to a share in the invention, and that Congress would not act on the appropriation bill.

Smith returned to politics, the Vails were suffering from the financial depression which set in during 1837, Professor Gale had limited financial means, and Morse found himself once again without funds or supporters.

In Paris he had met M. Daguerre, the discoverer of photography, and had learned the process while there. He fitted up a studio on the roof of the University of the City of New York, and with Dr. Draper as a partner, made the first daguerreotypes ever produced in America, and attempted to eke out a living by giving lessons in art to a few pupils, but he was at that time in dire financial distress.

A patent was issued to him on the telegraph in 1840, the issuance of which had been delayed at his own request, as he desired first to secure his foreign patents, his American rights being protected by the caveat. Although the commercial possibilities of the telegraph had not been established he found himself troubled with the rival claims of those who sought to secure a share in his invention.

CONGRESSIONAL ACTION AT LAST

With bulldog tenacity Morse dogged members of the House of Representatives to revive the appropriation bill now that a political campaign was over and was rewarded by having the Committee on Commerce again recommend an appropriation of \$30,000 for the Washington-Baltimore experimental line. The bill finally passed the House by a scant margin of six votes, but it seemed to have no chance in the Senate. Morse went to Washington to press his plan in the upper branch of Congress, and when the measure came up late one evening just before adjournment, he sat in the gallery awaiting the result, when he was observed by one of the Senators who came up and said to him: "There is no use in your staying here. The Senate is not in sympathy with your project. I advise you to give it up, return home, and think no more about it."

Morse went to his room with a heavy heart, paid his board bill, and found himself with thirty-seven cents in his pocket. Early the following morning Miss Annie Ellsworth, daughter of the Commissioner of Patents, the latter a close friend of the inventor, visited Morse at his boarding place, and said, "Professor, I have come to congratulate you." "Congratulate me!" replied Morse, "on what?" "Why," she exclaimed, "on the passage of your bill by the Senate!" Investigation proved that in the closing moments of the session, the measure had been adopted without debate.

Morse afterward stated that it was the turning point in the history of the telegraph, as his resources had been so reduced there seemed no likelihood that he would have again been able to bring the problem before Congress.

He was so grateful to Miss Ellsworth for her interest in bringing him the good news that he promised that she should have the honor of sending the first message upon the completion of the experimental line, work upon which was immediately begun by him, with Messrs. Gale and Fisher as his assistants, and with Alfred Vail in direct charge of the work

of construction. Ezra Cornell, destined later to found Cornell University, was active in the enterprise, having invented a machine for laying wires underground in a pipe.

The original plan was to place the wires underground, a policy which was considered essential to their protection, but after running the line some five miles from Baltimore it was found that this method was futile, as the insulation proved inadequate and prevented the operation of the line even to the first relay station. A considerable portion of the \$30,000 had been spent; the line was still far from completion; disaster appeared imminent; Smith, who held one of the contracts to lay the line demanded most of the remaining funds, and a quarrel was precipitated between him and Morse which further jeopardized the undertaking. After a long consultation, it was decided to string the wire on poles by boring a hole in each pole and pushing the wire through—a long and perilous task. Later, it was found necessary to insulate the wire with necks of bottles where it passed through the poles.

“WHAT GOD HATH WROUGHT”

Finally, on May 23, 1844, the line was completed, and on the following morning Morse called on Miss Ellsworth to give him the first message. She chose the words: “What God hath Wrought,” and early that day Morse took his position at the transmitter in the Supreme Court room at the Capitol and telegraphed this immortal message to Vail, at Baltimore, where it was received without interference, and relayed back to the inventor. The magnetic telegraph was an actuality, but the public remained unconvinced. A dramatic incident was required to demonstrate its practicability, and fortunately for Samuel F. B. Morse the opportunity came speedily.

The Democratic national convention was in session in Baltimore, where, after an exciting session, the name of President Martin Van Buren as a candidate for nomination was dropped and that of James K. Polk was substituted. Silas Wright was named for vice president, and Vail learning of this action, wired it to Morse at the Washington end. The latter communicated with Wright who was then in the Nation’s Capitol, and who promptly declined the honor. Morse took Wright’s formal declination to the Capitol, telegraphed it to Vail, and a few minutes later the latter presented it to the convention delegates to their intense surprise. They refused to believe that Wright had been communicated with, and appointed a committee to go to Washington, interview the nominee, and report back to the convention. The group found the message was genuine, and thus the utility of the telegraph was established.

Not until April 1, 1845, was the experimental line placed on a commercial basis and operated as a branch of the U. S. Post Office Department.

MORSE OFFERS THE TELEGRAPH TO THE GOVERNMENT FOR \$100,000

In accordance with the terms of his agreement, Morse offered the telegraph to the United States for \$100,000, but with the customary exhibition of official stupidity and lack of business acumen which the Congress can be expected to stage whenever a good opportunity presents itself the offer was spurned, due largely to the recommendation of Hon. Cave Johnson, then Postmaster General. He had been a member of Congress

at the time the appropriation of \$30,000 was granted, and one of its most bitter and unreasoning opponents. The nation was so unfortunate as to have him in a cabinet position at this period, and as a demonstration of his colossal business incapacity it is interesting to note that while his official report said "The operation of the telegraph between Washington and Baltimore had not satisfied him, that under any rate of postage that could be adopted its revenues could be made equal to its expenditures," time proved the telegraph, then offered to the Government for a paltry \$100,000, was developed under private management until it paid a satisfactory profit on a capitalization of \$100,000,000. Thus was lost, through the stupidity of a Simon-pure politician the only opportunity the Government has had within its grasp in its entire existence to place the Post Office Department on a paying basis. While no student of economics would for a moment pretend that the American public would have been as well served under Government operation as under private management and while it is infinitely better off today because of the policy adopted, yet the nation might well have vastly enriched its coffers had it accepted Morse's offer, and then later sold the telegraph franchise to private interests at an enormous profit.

The inventor was inspired in making his offer by a truly patriotic motive as well as by a desire for immediate financial return and freedom from further worries, and at the moment Morse was deeply disappointed by the refusal of Congress to favorably consider it. However, it was well for his own welfare that it was left to private capital to develop the telegraph, as he became a wealthy man from his invention.

Amos Kendall, who had served as Postmaster General under President Jackson, became associated with Morse, and after making plans for a line between New York and Philadelphia, an exhibition of the telegraph and a demonstration of its practicability was staged in the former city, at a charge of twenty-five cents a head, which proved to be a complete dud, the public refusing to patronize it in sufficient numbers to pay the expenses, while the capitalists whom the promoters sought to attract departed without investing in the enterprise, once they noted the shabby and poverty-stricken appearance of the exhibitors and attendants. Some of the group in charge of the exhibition slept on chairs or on the bare floor, and it is told that Ezra Cornell, who was one of the group and who was to lend his name and give a share of his fortune to Cornell University in after years, was overjoyed at finding a quarter on the sidewalk outside the display room, with which he bought the first hearty breakfast he had enjoyed for some time.

THE MAGNETIC TELEGRAPH COMPANY

Although men of large means could not be induced to invest, many in humble circumstances who recognized the potentialities of the telegraph purchased stock in the Magnetic Telegraph Company, and thus helped to link the nation together by electric wires.

In August, 1845, Morse went to Europe to enlist foreign capital, but with no more favorable result than he had achieved at home, and he returned convinced that the telegraph could and would succeed on American financing alone.

The year following the completion of the New York-Philadelphia line witnessed the completion of one from the latter city, to Washington, via

Baltimore and in December, 1847, the Philadelphia-St. Louis line was finished.

When Henry O'Reilly, of Rochester, N. Y., attempted to establish "The People's Line" from St. Louis to New Orleans, Morse instituted legal action for infringement of his patents, which resulted in a signal victory for him. Although the courts repeatedly upheld his patent rights, the pirating of the telegraph continued.

In 1856 came the organization of the Western Union Telegraph Company an amalgamation of the scattered and competing lines, under the management of Hiram Sibley. When the new company declined to extend a telegraph line to the Pacific Coast, Sibley with sublime courage and enterprise, began it on his own private initiative, and the U. S. Government, realizing the military and administrative value of the work, subsidized the movement, additional funds were raised, a route selected through Omaha and Salt Lake City to San Francisco, and in five months' time the line was completed.

Sibley and the other American telegraph pioneers began plans for spanning the globe, their idea being to unite America and Europe by a line stretched through British Columbia, Alaska, the Aleutian Isles, and Siberia, which comprehended only short submarine cables. The expedition started in 1865, with a fleet of thirty vessels carrying the supplies. Tremendous difficulties had been overcome and a considerable part of the installation accomplished when the successful operation of the Atlantic Cable rendered the work useless after an expenditure of nearly \$3,000,000.

Honors came to Morse both at home and abroad as the telegraph became established in all parts of the world. Orders of Knighthood, medals and decorations galore were conferred upon him. Although he had failed to secure foreign patents, many of the nations abroad recognized the value of his invention and France, Austria, Belgium, the Netherlands, Russia, Sweden, and Turkey, and some lesser powers joined in paying him a testimonial of 400,000 francs.

Great Britain alone, of the large foreign countries, did not join in this tribute, although Morse's system had been adopted there in preference to Wheatstone's.

In 1871 a statue in honor of Samuel F. B. Morse was erected in Central Park, New York City, and in the spring of the next year one of Benjamin Franklin was unveiled, with Morse presiding at the ceremonies.

He received a tremendous ovation, but the cold of the day proved a great strain on his physical condition, and contracting illness as the result of the exposure he died on April 2, 1872, at the age of eighty-one years.

Thomas Alva Edison, who began his career as a telegrapher, took up the projection of the telegraph where Morse and Vail left off, first inventing duplex and later quadruplex telegraphy, and finally the automatic telegraph, which enabled 3,500 words a minute to be transmitted between New York and Philadelphia.

CYRUS W. FIELD—FATHER OF THE ATLANTIC CABLE

On the thirtieth of September, 1819, when Samuel F. B. Morse was twenty-eight years of age, there was born in the Berkshire County town of Stockbridge, one who was destined to become internationally associated with the inventor of the telegraph in an effort to unite the eastern and western hemispheres with strands of wire that would provide instantane-

ous communication. Morse had been the first to actually lay an experimental cable under the sea, when, in 1842, using tarred hemp and India rubber for installation purposes, he sank a line in New York Harbor. Three years later, one of his associates, Ezra Cornell, laid twelve miles of cable in the Hudson River, and connected Fort Lee with New York City.

Probably Morse was the first to suggest the possibility of uniting America and Europe by cable, but the undertaking was so vast and the problems involved so little understood that for many years no man was bold enough to undertake the project.

F. N. Gisborne received a concession to lay a cable between New York and St. John's, Newfoundland, in 1852, and began the work of construction. Cables were required to connect Newfoundland with the continent, and to cross the Gulf of St. Lawrence, but the rest of the line was to be strung through the forests.

Little had been accomplished before Gisborne ran out of funds and work was suspended. In 1854 he met Cyrus West Field, then of New York, who had left Stockbridge in his young manhood to gain an immense fortune as a New York merchant, and who even at that early time in life had retired from active business cares.

Field became intensely interested in the Gisborne project, and as he examined the globe in his library the thought came to him that the line to St. John's was but a start on the way to England. His enthusiasm was aroused, and he determined to embark upon the gigantic enterprise, despite the fact that he knew nothing of telegraph cables or of the bed of the Atlantic.

Consulting Lieutenant Berryman of the United States Navy, who had been engaged in sounding the bottom of the sea between Newfoundland and Ireland, Field learned from him that the ocean bed was a comparatively level plateau, covered with soft ooze, and at a depth of about 2,000 fathoms—a fact which seemed to experts to have been provided for the especial purpose of receiving a submarine cable, so admirably was it suited to this purpose.

Field next conferred with Morse and was assured by him that the project was entirely feasible, and that a submarine cable once laid between the continents could be operated successfully. Whereupon Field adopted Gisborne's plans as the first step in the major undertaking. The initial attempt to lay a cable across the Gulf of St. Lawrence, in 1855, was frustrated by a severe storm, which made it necessary to cut the cable to save the ship from which it was being laid. The second attempt the following summer, with better equipment, was successful, and as the other parts of the line had been completed, the telegraph then stretched a thousand miles toward England, and New York City was connected with St. John's.

Field next secured the coöperation of Lieutenant Berryman of the United States Navy, in the *Arctic*, and Lieutenant Dayman of the British Royal Navy, in the *Cyclops*, both of whom made a careful survey of the ocean bed along the remainder of the proposed route, the soundings revealing a ridge near the Irish Coast, with a gradual slope.

The preliminary work had been accomplished by an American company, with Field at its head and Morse as the electrician, both natives of the Bay State. Field went to England to secure capital for the larger enterprise, and organized the Atlantic Telegraph Company, to which he

subscribed one-fourth of the entire capital. Charles T. Bright, an Englishman, became engineer of the new corporation, and singularly enough Professor William Thomson, who worked out the law of retardation so accurately and who was added to the forces, was destined to become the chairman of the jury of awards which, in 1876, passed upon the original telephone installed at the Philadelphia Centennial, by another Massachusetts inventor—Alexander Graham Bell. Thus Lord Kelvin, for such Thomson became a few years later, was associated with two of the most eminent Massachusetts inventors of all time—Samuel F. B. Morse and Professor Bell.

The story of the making of the original cable; the two unsuccessful attempts, followed by the laying of the cable on the third trial, only to have it part after a brief use of it; Professor Thomson's inventions and discoveries; the construction of an improved cable and apparatus; the genius and energy of Field in keeping the prospect alive following repeated failures; his sixty-four Atlantic crossings in behalf of the great enterprise he had conceived; his raising of \$3,000,000 to provide a cable of an improved type; the purchase and equipment of the *Great Eastern*; the parting and loss of the new cable, with its subsequent recovery; the linking of the two continents at last; the commercial success of the stupendous undertaking and the public jubilation following the successful outcome—all these are familiar to the student of history.

But it is to Cyrus W. Field, a son of Massachusetts, that must be assigned the greater share of the credit for telegraphic communication between the continents. He gave his fortune and all of his tremendous energy and ability and kept it alive through failure after failure. While a promoter of the highest ethics, he proved himself to be the sagacious business man who recognized a great human need and a wonderful opportunity to render genuine service to mankind.

Without his leadership the scientific discoveries of Morse and Thomson could scarcely have been put to major use in under-sea communication.

W. W. WINSHIP, INC.

In 1755, Zachariah Hicks was born in Cambridge, the son of John Hicks, one of the first victims of the War of the Revolution.

The son, Zachariah, a young man of twenty, on April 19, 1775, fought in the ranks of the Watertown company, at the time he was serving his apprenticeship to Thomas Patten, a saddler of Watertown.

On the evacuation of Boston by the British, young Hicks opened a shop at 38 Cornhill, now Washington Street, where he was located as a saddler and trunkmaker for forty-one years thereafter.

When Washington visited Boston in 1789, he was one of the marshals of the procession and he also served the town as representative to the General Court for two terms.

Changes in Washington Street in 1817, when the present Cornhill was laid out, made a removal necessary, and he opened a shop on Court Street. Among his workmen was Charles McBurney, who in 1833 commenced business on his own account, and Mr. Hicks retired the same year.

About 1837, Henry A. Winship was apprenticed to Charles McBurney and in 1842 purchased his interest and started business under his own name, at 12 Court Street—the same locality where Mr. Hicks' sign had been displayed twenty years previously.

In 1843 Winship moved his business to 13 Elm Street and three years later formed a partnership with F. V. Stowe, under the name of Winship & Stowe, at the same location.

In 1849 this was dissolved and G. W. Willis became a partner with Winship under the name of Winship and Willis until 1853, when the latter retired and E. A. G. Roulston took his place, the firm continuing under the name of Winship and Roulston until 1856. Mr. Winship continued under his own name until 1860, when he was burned out by fire, and two years later he resumed business in the same line at 7 Tremont Street.

In 1869 he formed a partnership with S. G. Cheever, which continued for two years, when Charles Easter joined forces with Winship, under the firm name of Henry A. Winship & Co. In 1876 Easter retired and Mr. Winship continued under his own name at 16 Tremont Street the rest of his life, with the exception of the time when the present Hemenway Building was being built. His career in the business covered a great part of the last century, and upon his death in 1909, at the ripe age of ninety years, his nephew, William H. Winship, long connected with him, continued the activities.

In 1852 William W. Winship entered the trunk business in the employ of his brother, Henry A., first as a trunk-maker and later as a salesman, and six years later he established a wholesale trunk business at 13 Elm Street, in the same building in which his brother conducted a retail store, where both remained until 1860, when they were burned out.

In 1861 W. W. Winship formed a partnership with Samuel Easter under the name of Easter & Winship at 20 Elm Street and a year later they moved to 3 Elm Street and in 1868 to 7 Elm Street, where they remained until 1876. That year Easter & Winship dissolved partnership and W. W. Winship reestablished the business under his own name for two years at 14 Elm Street and in 1880 moved back to the old stand at 7 Elm Street.

In 1899 W. W. Winship moved to 71 Summer Street, where he continued the retail trunk and bag business in a larger and more up-to-date store, and carried on manufacturing of all kinds of trunks for the wholesale and retail trade.

In 1911 he operated an outside factory at 37 Wormwood Street.

In 1918 the William W. Winship business at 16 Tremont Street was consolidated under the name of W. W. Winship, and in 1921 the 16 Tremont Street store was moved to 392 Boylston Street.

In 1910, W. W. Winship purchased the Faber trunk factory in Utica, N. Y., and his son, Albert W. Winship, moved with his family to Utica to take charge of the plant.

William W. Winship died in 1919 at the age of eighty-seven years, and that year a stock company was formed under the name of W. W. Winship, Incorporated, doing business at 71 Summer Street, and 11 Kingston Street.

In 1911 the Utica business was incorporated under the name of W. W. Winship Sons & Co.

William H. Winship entered the trunk business in 1887, first with his father, W. W. Winship, at 7 Elm Street, where he remained about one year until his uncle, Henry A., induced him to go in business with him at 16 Tremont Street.

William H. soon became the general manager of the business and held that office until the death of Henry A. in 1909.

He continued the business under his own name at 16 Tremont Street until 1918, when he consolidated with his father and brothers at 71 Summer Street.

In 1891 Stephen E. Winship, son of William W., entered the trunk business with his father at 7 Elm Street, and it was through his judgment and foresight that the business was moved to 71 Summer Street in 1899, following which he became practically the general manager of the concern and as such he so remains.

In 1919 a stock company was formed under the name of W. W. Winship, Incorporated, with Stephen E. as president and later as treasurer.

Albert W. Winship, son of William W., entered the trunk business in 1901, at 71 Summer Street, where he acted as salesman and later took over the management of the manufacturing end of the business in Boston until 1912, when he moved with his family to Utica, N. Y.

Being of a practical frame of mind, he invented the famous Winship wardrobe trunk with doors, the migrator hat box for ladies, the feather-lite suitcase, the fortniter valise for men and women and many other equally popular styles of travelling pieces of baggage.

In 1911 Walter W., another son of William W. Winship, entered the trunk business, first as a salesman, and later as sales manager and purchasing agent. In 1925 he became the president of the corporation, which position he still holds.

Miss Nellis S., daughter of William W. Winship, has acted as book-keeper at 71 Summer Street, since 1899.

OTIS CLAPP & SON, INC.

Ninety years ago, when Bostonians traveled in chaises, if they were so fortunate as to ride at all, Otis Clapp, who for some years previous had resided in the Hub, where he had been employed on the *Boston Advertiser* and subsequently had published periodicals and books, including the initial Boston Directory, opened a pharmacy at 23 School Street, which he removed to 3 Beacon Street ten years later, where it remained until 1885, when the building it occupied was razed.

Moving to a next door store the enterprise was transferred in 1886 to 10 Park Square, with laboratories on Eliot Street, and with a part of the business being carried on at 17-19 Carver Street. A branch store was opened at that time on Beacon Street, at Tremont Place, which was later removed to 8 A Beacon Street, and in the '80s a branch was opened in Providence, R. I.

In 1922 a completely equipped laboratory for research and standardization was established at 344 Newbury Street. Otis Clapp contributed his share to the services of the public, serving as a member of the Massachusetts Legislature, as a Boston alderman, and as chairman of the board in 1860, while as acting mayor he defended Wendell Phillips at an anti-slavery meeting in Old Music Hall from mob violence. His efforts in behalf of the extension of the street railway system of Boston caused his defeat for reelection. He actively promoted the Hoosac Tunnel, and became one of the founders of the Massachusetts Institute of Technology and the Massachusetts Homeopathic Hospital; was a sponsor of the Home for Little Wanderers, active in temperance movements, and served as the

Federal Collector of Internal Revenue in Boston from 1862 to 1875, his commission bearing the signature of Abraham Lincoln.

His son, James W. Clapp, became a partner in the business January 1, 1874, when the firm name was changed to Otis Clapp & Son, and at which time it entered the manufacturing pharmacist field.

In 1901 the enterprise was incorporated, and that year Lowell T. Clapp, Ph. C., son of J. Wilkinson Clapp and grandson of the founder, became treasurer and later also business manager, representing the third generation of the family to direct its affairs.

The corporation is primarily a pharmaceutical manufacturer to the physician trade, not only in New England, but in other parts of the country, where its sales representatives are in constant touch with the medical profession. It maintains two laboratory buildings and conducts three retail stores, in addition to a biological and research laboratory, and included in its personnel are a professor in pharmacy, a former instructor in pharmacy, a former instructor in chemistry, a biological chemist, two graduates in medicine, two pharmaceutical chemists, nine registered pharmacists, and a chemical engineer.

The company's main offices are at 439 Boylston Street, Boston, where is also a part of the manufacturing laboratory, but the balance of the production and the research and standardization activities are carried on at 344 Newbury Street.

A retail store is operated at 8 A Beacon Street, and a retail and wholesale branch at 417 Westminster Street, Providence, R. I. Approximately seventy-five persons are employed by the corporation.

J. W. Clapp is president, Lowell T. Clapp, treasurer, and E. I. Perkins, assistant treasurer, and the board of directors is made up of Messrs. J. W., L. T., and G. R. Clapp.

THE LOOSE-WILES BISCUIT COMPANY

It was in 1840 that the present Boston plant of Loose-Wiles Biscuit Company really had its beginning, for it was in that year that the firm of Fowle and Austin was founded.

In that era, Boston was a thriving seaport, while New Bedford whalers, Salem clippers and other ships sailing from New England ports—Bridgeport, New Haven, New London, Narragansett Bay, New Bedford, around Cape Cod to Salem, Newburyport, Portland, and beyond—were known all over the world. The seagoing trade was then the most important New England industry. Under such conditions, and with such a tremendous trade as a market, it was but natural that bakeries were established largely to manufacture ship and pilot bread, and the firm of Fowle and Austin had as its principal purpose the manufacture of these commodities.

In the early '50s the name was changed to Thomas Austin & Company. In 1861 the firm moved to Chelsea. Three years later the concern became known as Charles F. Austin & Co. During the Civil War, large quantities of navy and hard bread were manufactured for the Federal forces, but after peace came the ship and pilot bread business gradually decreased.

For twenty years, Charles F. Austin & Company carried on successfully, and in 1884 the name was changed to Austin & Graves. Sixteen

years later Austin, Young & Company succeeded Austin & Graves, and, in 1906, the name was changed to the Austin Biscuit Company.

In 1908 the concern returned to Boston from Chelsea, and on March 27, 1909, it became the Loose-Wiles Biscuit Company. The Boston unit is now an integral part of that organization, which operates ten factories and 120 agencies and serves the nation with Sunshine biscuits.

Twenty years ago the Boston plant had one branch agency. Today it has twenty-one.

In 1908 the icing department occupied 5,000 square feet and today this one unit requires 35,000 square feet at the Boston plant.

The crisp, flaky pilot bread as now manufactured by the company is quite different from the old time product, but it is still the favorite staple cracker among seafaring people along the New England coast. The Navy bread has nearly disappeared, although the company occasionally stocks a fishing vessel or an exploration expedition. In place of the ship bread business which years ago constituted the most important part of the production, the company has created hundreds of new varieties of bakery commodities. It was at the Boston plant that Sunshine Hydrox, known as the king of biscuits, was originated, and here also that the foundation was laid for the great volume of the English Style biscuits produced by the company.

In 1908 the concern first occupied its famous Sunshine plant, where 1,000 operatives are employed. B. L. Hupp is president and E. W. Rice, secretary and treasurer of the corporation, which has capital of \$200,000.

THE BOSTON & LOCKPORT BLOCK COMPANY

In 1840 the Boston & Lockport Block Company was established and for ninety years it has manufactured tackle blocks for world consumption, and also specializes in Star Metaline, Ferrall's cargo hoisters, wire rope blocks and diaphragm pumps.

Approximately ninety per cent of the company's production is marketed outside of New England territory, thus indicating the widespread distribution of its manufactures. The corporation has capital of \$450,000 and employs upwards of two hundred operatives. Campbell Bosson is president, Horace P. Abbott, vice president, Norman E. Pearl, treasurer, and Sidney M. Stewart, secretary.

SOME INDUSTRIES OF THE FORTIES

Messrs. Rogers and Wendt located at 4 Court Avenue, Boston, in 1840 and began the manufacture of hollow ware, employing about forty men.

Obadiah Rich became a celebrated Boston silversmith and was the maker of the famous Webster vase, the largest piece of plate ever produced in America up to the time of its completion. He also made the Cunard vase and the set of famous gold coffee cups ordered by the Imaum of Muscat, which cost \$1,500 a dozen, although only the size of hen's eggs. In 1849, Mr. Rich retired, being succeeded by Samuel T. Crosby, who carried on the business at 69 Washington Street.

Messrs. Prouty & Mears of Boston received in 1841 patents on improvements to ploughs, and became extensive producers of agricultural implements.

William White established a printing plant at 4 Spring Lane, corner of Devonshire Street in the early forties, and for many years he was chosen

by the Massachusetts Legislature as the state printer. During that period he brought out a number of the records of Massachusetts, from 1628 to 1641, in a peculiar style and type that received high commendation from competent judges, not only in this state but in England. When White came to Boston to locate in 1839, after serving an apprenticeship of nine years he had no capital, but his promptness in filling the first few simple orders he received, resulted in friends coming to his assistance, and ten years later he possessed steam power presses and a complete equipment, and employed fifty hands.

WALWORTH—A MASSACHUSETTS INSTITUTION

At the period when Abraham Lincoln was an Illinois rail splitter; when the frontiers of American civilization had not been extended beyond the plains of Missouri; when the red man was still a menace to the settlers of the West; before the Alamo and Santa Ana were translated into the annals of imperishable history; when John Tyler was President of the United States and the immortal Daniel Webster was one of his cabinet officers; in the days when whale oil and tallow dips illumined the American home; when no bands of steel spanned the continent from the Atlantic to the Pacific; long before the first ocean cable kissed the sands of the sea; nearly a score of years previous to that hour when the North and the South submitted their differences to the dreaded arbitrament of war; at a time when the use of steam was in its infancy and electricity was practically an unknown quantity, James J. Walworth and Joseph Nason formed the partnership of Walworth & Nason, to further a scheme for installing what at that time was a new heating device designed for business buildings and residences—a dubious venture at its best when one realizes that the era of mechanical inventions and scientific development which completely revolutionized American industry during the latter half of the nineteenth century, was not yet launched.

In 1841, Joseph Nason, a shrewd young man with unusually keen powers of observation and rare business instinct, went to Europe and, while in London, became acquainted with Angier M. Perkins, who was then experimenting with a mechanical device for warming houses by the use of hot water conveyed in wrought iron pipes, and who was credited with perfecting the first hot water heating system in England.

Nason became enthusiastic and, in a letter to his friend, James J. Walworth, proposed that they purchase a quantity of small pipe and introduce the heating plan in America. Returning home the latter part of that year, the partnership was effected, and an announcement was made by the firm that it was to engage in "warming and ventilating buildings by means of steam and hot water apparatus." There is nothing in the history or the traditions of the Walworth & Nason enterprise to indicate that at the outset it was to utilize steam for heating purposes, as the idea of actually using energy of that type in heating was not developed until three years afterwards.

In 1842 the two partners decided that Boston would prove a better location for the business than New York, and finally the die was cast and the Metropolis lost the prestige of becoming the habitat of the great corporation that ultimately emerged from this pioneer enterprise—The Walworth Company, of Boston, now employing 5,000 hands in its several plants.

For two years, the concern struggled along, the original plant being located in Blake's Court, a thoroughfare no longer in existence, but then situated in the vicinity of Northampton Street, Boston.

Here patterns for globe and angle valves, cocks and fittings, were designed and the material manufactured. Mahogany was generally used for the patterns. The threads in fittings and valves were chased, not tapped. A fitting would be placed in a chuck and, after being carefully centered, a cutting tool would make several cuts to bring the opening to gauge, when the thread would be chased with a chaser.

In July, 1847, James J. Walworth went to England, where he visited the pipe mills of James Russell & Sons, and Lloyd & Lloyd, Glasgow. On his return he engaged the services of Robert Briggs, the originator of the Briggs standard of pipe threads (still in use), who was then connected with the Pascal Iron Works, in Philadelphia. A corporation was formed called the Wanalancet Tube Company, and a mill built at Edgeworth, in Malden. The engineers' estimate of the cost was \$65,000—\$20,000 of this amount being subscribed by the townspeople while Walworth & Nason took the balance of the stock.

The first pipe, a small run of three-quarters and one-inch, was made November 3, 1849. The mill continued in operation, turning out pipe up to two-inch until December, 1851. The cost of the plant, instead of being \$65,000, was actually \$135,000.

THE FIRM INSTALLS THE FIRST STEAM HEATING PLANT IN THE WORLD

In 1844 Walworth & Nason took a noteworthy step in the annals of American industry. They proposed to warm houses by steam. This was a radical idea, an entirely new departure in this country or anywhere else. No doubt the scheme was greeted with a great deal of skepticism by conservative New Englanders, but Walworth & Nason were determined to try the experiment. Under the personal direction of J. J. Walworth a steam heating system was installed in a large woolen manufacturing house in Boston, and the day that steam was turned on and the building successfully heated, marked a new era in American industry.

There is no doubt that the steam heating industry of the world was originated by Walworth & Nason, and that it had its inception in Boston. During the thirty years following 1844 nearly all the activities of the concern consisted of contracting for and installing steam heating plants throughout the eastern half of the United States. Hundreds of steam fitters received their diplomas from the house of Walworth & Nason, and, by 1870, it was a common remark in the trade that "if you scratched any steam fitter deep enough you will find the name Walworth somewhere beneath his skin."

The chief difficulty of the concern lay in the inability to purchase fittings for the pipe, and as there were no American concerns then engaged in the manufacture of pipe fittings, the partners determined to enter the field themselves and thus avoid the unconscionable delays in shipments from Europe.

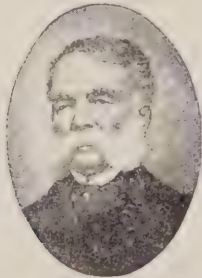
It is interesting to note that this decision was the beginning of that factor in the enterprise which was destined to assume more and more importance until finally it came to dominate the company. Undoubtedly, had there been an available source of supply Walworth & Nason would

not have attempted to manufacture their own fittings, and in that event probably would have remained a steam contracting concern.

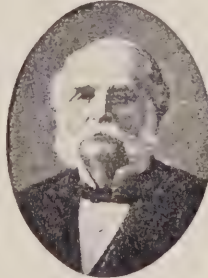
THE CONCERN VENTILATES THE WHITE HOUSE

In 1845 James J. Walworth's invention of a ventilating system by means of fans, propelled by steam, was first applied to the old Boston Custom House, and later was generally used in hospitals, asylums, and large public buildings, including the Philadelphia Academy of Music, The White House, in Washington, D. C., and Music Hall Boston. Probably the most ambitious installation was that placed in the Boston City Hospital (then the Free City Hospital), where the aggregate cubic capacity of all the apartments ventilated was approximately 1,000,000 feet. The change of air was effected by means of a fan, that forced fresh air through air-chambers into registers located in the rooms, changing the entire quantity of air in a ward or supplying its equivalent, every fifteen minutes. A novel method of regulating the supply and temperature of fresh air admitted to the wards was evolved, consisting of a double set of flues, one carrying cold and the other warm air, so arranged that the two currents could be combined and mixed at the point of ingress, thus affording facilities for controlling the temperature of the rooms without diminishing the quantity of air required for ventilation.

In 1852 Joseph Nason, who was not enamored of Boston's east wind and its severe winters, withdrew from the firm to enter business for himself in New York City, and J. J. Walworth & Co., was formed with Messrs. J. J. and C. C. Walworth and Marshall Scudder, as the owners.



J. J. WALWORTH



C. C. WALWORTH

In the late fifties the firm established a manufacturing plant in Cambridgeport in order to increase its facilities, and in 1868 it maintained a Chicago house although possibly not in the name of the firm, but under a caption in which the name Walworth appeared.

The fittings made at Cambridgeport prior to 1872 were confined almost entirely to attachments for use on steam heating lines and to valves for similar use. The manufacture of fittings for factory use was not developed extensively until afterward when America began her remarkable industrial growth. However, J. J. Walworth & Co., at that period, made a number of special tools, among which was a pipe vise, that has remained a popular and necessary asset to the steam fitter ever since and known as the famous Walworth pipe vise, fashioned then practically as it is today.

The Cambridgeport plant was equipped in later days with a small foundry, blacksmith shop, pattern shop and crude drop forge, the latter not being added until some time after the firm of J. J. Walworth & Co., had passed out of existence, and had become a corporation. It was a modern plant in its day, but the location was not convenient, since all products had to be transported in wagons to Boston, a distance, of about three miles.

Caleb C. Walworth was the inventor of the patented Walworth manifold fitting, a patented solid die plate, and a machine for cutting gas fittings, which used three taps simultaneously.

AMERICA'S MOST FAMOUS TOOL—THE STILLSON WRENCH

Col. Levi R. Greene, who served his apprenticeship in the Corliss Engine Works before the Civil War, and who was an engineer on a naval vessel during the Rebellion, had, as a fireman on the craft, a young man named Daniel Stillson, who appeared to possess unusual mechanical ability. In 1865, Colonel Greene entered the employ of the Walworth concern, and, much to his surprise, Stillson appeared one day seeking a job, and was hired as a mechanic at the Cambridgeport plant.

In 1869, he came to the office with the pattern of a new type of pipe wrench, which he had whittled out of wood. Greene was interested and authorized Stillson to have a wrench made of steel, after his model. When next he appeared Colonel Greene and C. C. Walworth examined the wrench and finally Stillson was directed to the pipe room, in the Devonshire Street shop, and was told to try the device on a section of 1¼-inch pipe. "I want you to put strength enough on that wrench," said Colonel Greene, "to twist off the pipe, or break the wrench. I don't care which."

Colonel Greene in telling the story years afterwards, said: "Dan looked at me with some strong language in his eyes. He was competent to use language, chiefly profane, and he exercised this accomplishment on frequent occasions. C. C. Walworth chuckled as Dan turned on his heel and walked out of the office. Half an hour later, he came back with a piece of pipe which had been twisted off. His wrench was intact.

"C. C. then became really interested and he told Dan to go back to the factory and have the foreman make up two dozen wrenches," continued Colonel Greene. "He and I agreed upon suggestions as to the length of the handles for the different sizes and Dan went away. He came back with the finished wrenches a few days later and was advised to go to the Patent Office and get a patent for his invention.

"'It is as much as I can do to get my dinner, to say nothing about going to the Patent Office,' said Dan."

C. C. Walworth, however, thought so well of the wrench that he authorized Stillson to draw upon the office for the necessary expense money and directed him to a patent lawyer, who had served the company. In the course of time, Stillson came back with his letters patent and asked Colonel Greene's advice as to how he should proceed.

Stillson's first thought was to sell the patents to J. J. Walworth & Co. His need of money was so great that he believed \$2,500 was worth more to him at that time than possible royalties in the future. Both Colonel Greene and C. C. Walworth advised Stillson against selling his patent and even when the inventor fixed \$1,500, as his price for the patent right, they urged him to adopt another course. Stillson finally took their advice

and agreed to grant the exclusive manufacturing rights to J. J. Walworth & Co. In return he asked for a royalty percentage which, according to Colonel Greene, made the sale of the wrench absolutely prohibitive in price. However, he was adamant and the company accepted his proposition and entered into an agreement to manufacture and sell the wrench at the figure named.

The trade was thoroughly informed of the possibilities of the new invention, but the wrench did not sell because the price was too high. After months of waiting, Daniel Stillson was persuaded to accept a royalty which permitted the manufacture and sale of the wrench at a more reasonable figure, and thereafter the Stillson Wrench was a marketable product, and became one of the world's best known inventions.

Royalties began to flow in until, in the later years of his life, Stillson was enabled to retire and live on the earnings of his invention.

Years later, Colonel Greene met Stillson leaving the office of the Walworth Company. In his hand the inventor carried some papers and a check, and he told Greene that the draft was for the last money he would receive for his wrench, as the patent had expired.

"How much has that little wooden model you brought into the office paid you?" asked Colonel Greene.

Stillson went through some rapid mental calculations and replied:

"Counting this check, I have received a little more than \$67,000 from the Walworth Manufacturing Company in royalties."

From other sources it is learned that he actually collected altogether, between \$80,000 and \$100,000, for this child of his brain.

The wrench was copied by many other companies after Stillson's patent expired, and is now being made by a dozen or more concerns in this country. The Walworth Company, however, retains the original patent form and it is universally recognized that Stillson's idea has never been improved upon to this day.

In 1872 the Walworth Manufacturing Company was incorporated, and succeeded the old J. J. Walworth & Co., partnership. That same year the new company suffered a net loss of \$60,000 over and above the insurance, as the result of the great Boston fire of November 9-10, but a gross business of \$1,000,000 was done in 1872. Not until 1880 did the company show a financial gain following the panic and hard times of 1873 and subsequent years.

THE FIRST RECIPROCAL TELEPHONE CONVERSATION WAS CARRIED ON OVER A WALWORTH WIRE

Famous as the concern has been in the annals of the industrial history of Massachusetts, few are aware that the first reciprocal telephone conversation that ever took place in the world over any considerable distance, and outside of a single building, was carried on by Alexander Graham Bell and Thomas Watson, over the two miles of telegraph wire that separated the Boston office of the concern from the Cambridgeport plant.

The vicissitudes attending manufacturing enterprises of long periods of existence are well emphasized in the story of the Walworth concern. In the seventies it engaged in the business of selling gas lighting plants for private residences and public buildings, and this line was so lucrative that, in 1882, the concern was able to declare the first dividend that had

been paid since 1872, and the earnings upon which it was based came largely from the gas lighting profits. But out of a clear sky came electric lighting and the gas proposition languished. Gasoline for lighting and heating purposes had been another profitable line for the Walworth organization, but electric lights dimmed the call for this commodity.

In 1881 the land on which the South Boston works stand today was purchased and a year later the company moved from Cambridgeport to the initial building, 400 by 60 feet, and to two small stone houses and a wharf that had been constructed at the new location.

With the advent of electric cars a country-wide demand for iron poles to support trolley lines was observed, and the Walworth company anxious to recoup the losses due to the cessation of its gas lighting and gasoline lines, began, in 1890, the manufacture of electric poles, leasing land in Pittsburg, and erecting a building there, which was equipped with furnaces. Wrought iron pipe now became a new product in the company's catalogue.



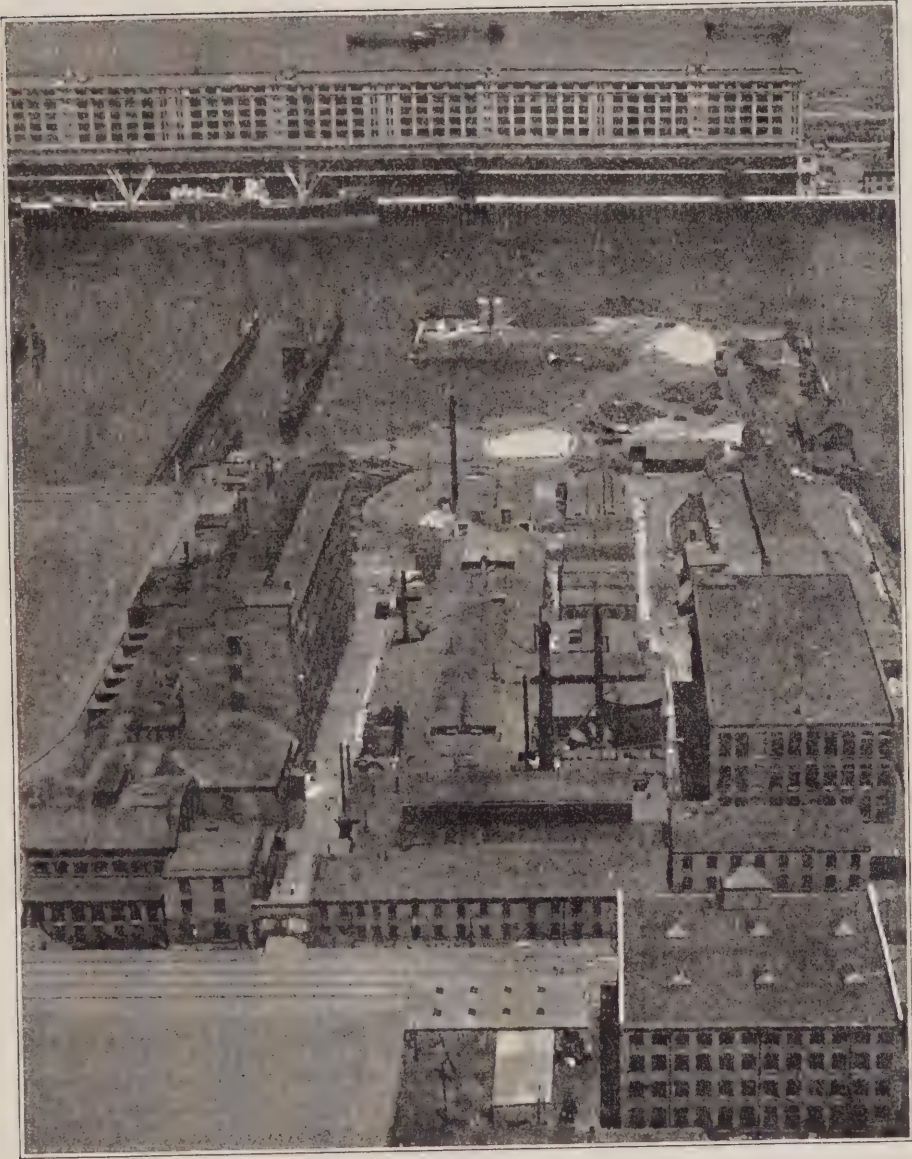
WALWORTH MANUFACTURING COMPANY
CAMBRIDGEPORT, 1876

In 1892, it had taken a lease, with the option to purchase, upon a tract of land on Congress Street, between B and C streets, Boston, and the following year it erected storehouses to provide much needed room for keeping a stock of pipe.

NEW BUILDINGS AND NEW LINES

In 1895 one of a series of pattern storehouses was built and an important addition to the main machine shop was made at the South Boston unit, and at the Congress Street plant pipe cutting and threading departments were added.

During the ten years that followed the Walworth Manufacturing Company began to concentrate more and more upon the manufacture of fittings, valves and tools. Certain types of valves for use in its steam heating business had been developed and were being manufactured, together with a complete line of iron and brass fittings. Nearly all of these products were used in connection with steam heating. In the early eighties the company had expanded its contracting business to include steam fitting jobs in large manufacturing plants and the manufacture of fittings was correspondingly enlarged.



WALWORTH COMPANY, BOSTON WORKS, BOSTON, 1928

In 1883 the automatic sprinkler business was added as a specialty. The company not only manufactured the device, but also contracted for installations and it became an important factor and continued to be one of its principal lines until 1903, when it was sold.

The early nineties ushered in the present era of high pressure steam. Power plants were erected in all manufacturing communities and there was a great demand for engineering skill in the installation of power piping. The Walworth Company entered the field with pipe bends, extra heavy fittings, valves and other high pressure materials.

In 1896 the company took a great forward step. Up to that year the eight-hour working day was practically unknown, and a majority of the manufacturing plants, as well as the contracting companies, employed their men from ten to twelve hours a day. The company decided to experiment with an eight-hour working day and voluntarily decreased the hours of the steam fitters from nine to eight hours. Today, the eight-hour working day is universal in the Walworth organization, and every reduction in hours has been a voluntary act upon the part of the company.

The eight-hour day led to another radical step involving manual labor—the adoption of a half-day holiday on Saturday.

Business had increased to such an extent in the Oliver Street store that the company sought another location and in 1898 purchased a large building on Federal Street, costing \$300,000.

In 1898 and 1899 the company erected at the South Boston plant a new machine shop, two stories high, 170 by 140 feet, and purchased the Congress Street land, which had been under lease.

In 1907 it began to turn its eyes to foreign markets and sent a resident representative to South America.

HOW THE COMPANY MET ANOTHER CRISIS

The original leaders of the company had passed away and the management was in the hands of a second generation of Walworth men who were well advanced in years. Another element that entered into the picture was the contracting phase of its activities. By arranging for the installation of its own material, Walworth was in direct competition with its customers who installed pipe fittings and valves. This caused ill feeling on the part of the latter, who felt that the company should confine its activity to manufacture, and leave fitting to the steam fitters.

The market had gradually narrowed down to the New England states. There were a few customers west of Albany, but with its principal competitors situated in the middle west, the Walworth organization was in a poor position to hold that trade because of the handicap of high freight rates from Boston. The New England field, on the other hand, was covered intensively by competitors and did not promise the company any great extension of business.

After seventy years of struggle and progress the Walworth organization now faced a crisis. Its problems had lost their local aspect and demanded vision, courage and energy for their solution. Obviously what was needed was young blood. The company was threatened with retrogression due to inertia. It was clinging to old-fashioned methods and policies. A new pilot was required, a man with foresight and ambition, with enthusiasm and confidence and with ability to bring Walworth to the forefront among American manufacturers in its line, and in 1912, How-

ard Coonley, and the founder of a successful enamel-ware manufacturing concern in Chicago, was called to the presidency of the Walworth concern.

He saw that the establishment of a sound financial policy, a broader market and a greater manufacturing output to meet that enlarged market were immediately necessary, and that the obvious remedy for the middle western situation was a new plant there. The factory of the National Tube Company at Kewanee, Ill., was purchased and occupancy began August 1, 1917.

Branch houses were established in Chicago, New York, Seattle, and Philadelphia, in addition to the one in Boston, and, in 1920, the export business was placed in the hands of the Walworth International Company and selling agencies were set up in Cuba, Argentina, Brazil, Chile, Australia and Mexico, while sales connections were established in England, France, Germany, Scandinavia, China, Japan, India, South Africa and Australia.

In the spring of 1918, President Coonley was drafted for service with the Emergency Fleet Corporation, and at a heavy personal sacrifice went to Washington as vice president of that war-time organization. Thereafter, until May, 1919, he spent his entire time in government service.

Problems of control and systematic operation were turned over to him, and in addition he relieved his associate, Charles Piez, of many of the details of active management. Howard Coonley and Charles Piez, under the leadership of Charles M. Schwab, Director General of the Emergency Fleet Corporation, made a record for efficient service that could hardly have been surpassed in any branch of the government service.

In 1925 the Walworth Company purchased the plants of the Kelley & Jones Company of Greensburg, Pa., and of the National Foundry Company at Attalla, Alabama, and these two units are now operated under the Walworth name. The corporation has capital of \$1,000,000 and now employs upwards of 5,000 men and women.

Walworth's latest product is chrome nickel iron pipe, which has a close-grained structure, permitting threading,—a distinct advantage for this type of product. It is stronger and more flexible than iron, and is designed to resist the corrosive action of soil, water or chemicals. It may be used in office buildings, dwellings, in chemical process lines, oil gathering systems, and buried lines, as well. To distribute it more easily, Walworth is centering a part of its production in the Alabama plant, which is located in the center of the coal and iron fields, and within convenient trading distance of the large mid-continent oil fields and industrial centers in mid-western and south-western states.

Walworth also has developed a product called Sigma steel, a cast steel product especially designed to be free from internal effect usually common to castings. Extensive X-ray work has been carried on by the company, and by studying defects in steel casting, Sigma steel has been developed. High steam pressures necessary in modern industry make such a high pressure product valuable, and in addition to resisting high temperatures it is of lighter weight than the usual materials employed. Valves and fittings are being made from this material. Howard Coonley is president, George A. Ricker, vice president and treasurer and Ralph B. Currier, secretary of the corporation.

E. B. BADGER & SONS COMPANY

In 1841, E. B. Badger & Sons Company was established and the concern has maintained its home office and main factory in Boston since that time, and for many decades has ranked as the leading distillation engineering and construction concern in the United States, maintaining a large force of technical experts and research and analytical laboratories and engineering and design divisions, as well as manufacturing and construction organizations and an operating personnel.

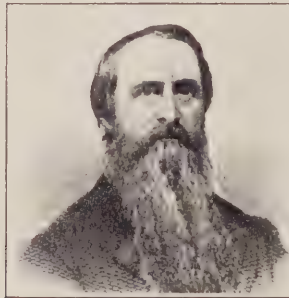
The corporation designs, constructs and operates complete plants throughout the United States and foreign countries for all types of distilled products, especially units for the atmospheric distillation of lubricating oils, the vacuum distillation of lubricating oils, refining by pressure distillation for the oil industry, and complete plants for the production of commercial alcohol, and the manufacture of special solvents, and solvent recovery work.

A list of the clients of this progressive Massachusetts company would constitute a roster of the leading oil refiners and chemical manufacturers of this country and abroad.

Offices are also maintained in New York, Los Angeles and Tulsa. It employs upwards of 300 men and women. Daniel B. Badger is president, Charles L. Campbell, vice president, Erastus B. Badger, treasurer, and Louis C. Doyle, secretary, of the corporation, which has capital of \$1,000,000.

PIANOS AND WALL-PAPERS

In 1842, I. Woodward & Co., began the manufacture of pianos, in Boston, the plant capacity being one instrument a week, but in 1845, when the firm became Woodward & Brown the business was moved to a six-story factory, at 387 Washington Street, where seventy-five workmen were employed.



J. R. BIGELOW
of Boston

Who, in the '60s, was at
the head of the J. R.
Bigelow Paper Hangings
Manufactory

The concern probably was the first of its kind to produce the parts in outside plants, the legs of these pianos being made at a factory in Rutland, the keys in Canton, the actions in Winchester, and the cases at their own steam mill in Boston.

In 1843, J. R. Bigelow invented and perfected machines for printing

wall-papers in two colors, and ten years later he produced the first successful machine for printing six or more colors in one operation. Previous to 1843, all domestic wall-paper was produced by hand.

With the introduction of wall-paper printing machines came the necessity of a process for continuous hanging of the paper and the rapid drying of the colors, and this was accomplished by Mr. Bigelow who evolved a series of air chambers, heated by steam pipes, through which the paper passed after coming from the machines, thus consummating a new era in the production of paper hangings. He erected a factory in Boston, the main building of which was 160 by 80 feet, four stories in height, with a separate structure 150 by 58 feet, a stone storehouse, 50 by 35 feet, and other smaller structures, which gave him nearly two acres of floor room, and afforded employment to more than 200 operatives.

THE COMING OF "THE BAY STATER"

In 1845, Messrs. Thompson and Wadsworth formed a partnership, which two years later became Wadsworth & Nye, and in 1850 Wadsworth, Nye & Co. Two years later the name was changed to Wadsworth, Nye & Crocker, and in 1856, to Wadsworth, Crocker & Co., and the following year to Wadsworth & Co.

In 1861 business was carried on as Crocker, Wadsworth & Co., and eight years later the name became Wadsworth, Howland & Co., which designation continued until 1874 when the concern became Wadsworth Bros. & Howland.

In 1884 the firm was known as Wadsworth, Howland & Co., and in 1893 the enterprise was incorporated as Wadsworth, Howland & Co., Inc., by which name it has since been known.

The original partners conducted a modest business behind a small counter, where they dispensed dry colors and oils, and from the germ of this enterprise has risen this internationally known New England paint and varnish manufacturing enterprise.

Early adopting as its trade-mark "The Bay Stater," the corporation has been active in building during the past twenty years a large and comprehensive dealer and industrial business, and by far the largest part of its volume has been attained during this period. During the rapid expansion of recent years, the company's executives have rigidly adhered to the standards of quality laid down by the founders and their successors, and supported by a consistent advertising campaign a consumer acceptance of its products equalled by few of its competitors has been attained.

On October 15, 1925, the assets of Wadsworth, Howland & Co., Inc., were transferred to the Devoe & Reynolds Company, Inc., and E. S. Phillips became president of Wadsworth, Howland & Co., Inc.

This change was due to the desires of the older members of the company to retire from active business and to be relieved of the burden in their latter years.

The change presented an opportune time for the promotion of a few of the younger men in the business who had been to a considerable degree responsible for its growth in the previous decades. They had been thoroughly trained under the old executives and were well equipped to assume the additional responsibilities thrust upon them, and they have carried on from where the older members left off and have introduced modern methods in many departments.

The company's manufacturing branch is constantly alert to adopt improved processes tending to reduce costs of production and raise the quality; machine methods have been installed wherever practicable, and products have been made more uniform and exact. A corps of chemists is employed in scientific research and in the development of new lines, and the company's retail stores are resorted to as a practical testing ground and laboratory for merchandising and advertising ideas.



WHERE WADSWORTH-
HOWLAND & COMPANY, INC.,
BEGAN BUSINESS

The present officers are E. S. Phillips, president, Renshaw Smith, Jr., vice president, general manager and treasurer, F. H. Appleton, manager of the New England district, C. S. Robbins, secretary and assistant general manager, and E. D. Swainson, factory superintendent.

At its Boston office, 141 Federal Street, and in its retail stores in Lowell, Lynn, Worcester and Springfield, and at its Malden factory, it employs upwards of 350 men and women.

B. O. & G. C. WILSON, INC.

Long before the advent of the telegraph and the telephone; at a period when the quaint little packet boats had not begun to feel the competition of the railroads, and when the electric light and the central power plant were unknown quantities, two boys, Benjamin O. and George C. Wilson, seventeen and nineteen years of age, respectively, set up, with the help of their father, Benjamin Wilson, a modest herb shop, at 18 Central Street, Boston.

It was in 1845 that they commenced the manufacture of pressed herbs and began a general jobbing business with physicians and hospitals. Ere long the two young men acquired a wide knowledge of the botanical drugs of the day, and came to be regarded as authorities on their uses. Follow-

ing the death of George C. Wilson, the father became associated with the firm, and in after years his other sons entered the business. One nationally known and widely advertised item on the market today was first made in a commercial way by Benjamin Wilson, and the firm developed a wide range of formulas which have been used by physicians generation after generation.

The founders and their successors have adjusted themselves to meet the recurring changes in the character of the drug business since the concern was formed eighty-five years ago and when physicians largely ceased dispensing drugs from their offices, and during the period when proprietary medicines were more in vogue than they are at present, the Wilsons found themselves in possession of a large number of formulas which stamped the company's products as distinctive.

Steadfastly maintaining quality in preference to rapid or phenomenal growth, or low prices, the company attained a high reputation which probably was not shared by many other houses in the Commonwealth, as its powdered drugs were used by the Massachusetts State Board of Health previous to the time that bureau was provided with its present-day well-equipped laboratory.

The company's high standards were again emphasized when the Federal Food and Drug Act went into effect, in 1906, every other house but one in the country finding it necessary to immediately issue higher price lists to cover the cost of the increased drug power of their respective preparations.

Benjamin Wilson died in 1914 and the following year a corporation was formed which acquired the assets of the partnership and which has since marketed the trade-marked proprietary specialties. Two of his sons continued with the company, and on an agency basis have developed the business until today it occupies a five-story building, and uses about 18,000 square feet of area.

When the company was incorporated, a trade-mark was adopted that was derived by transposing the letters "l" and "n" in the name of Wilson, thus producing "Winsol," which it uses together with the slogan, "Winsol, the line that wins-all."

Many of the corporation's formulas covering the best selling preparations are more than a century old, having been prepared and originally dispensed by the physician of the Wilson family for a number of years before the business was established in 1845.

The corporation has capital of \$2,800,000 and employs fifty hands. C. W. Wilson is president, William E. Ramsdell, secretary and G. L. Wilson, treasurer.

THE SAMPSON & MURDOCK COMPANY

Although the 1929 edition of the Boston Directory was numbered CXXV, the history of the present publishers, of that volume, as an unbroken sequence, goes back only to 1846.

The need of systematic information about people had made itself felt in Boston as early as 1789, however, when John Norman issued the first Boston Directory. This was one of the first publications of its kind in America, being antedated only by Philadelphia, in 1785, and New York, in 1786.

Norman's little paper-covered book of fifty-six pages presents an in-

teresting comparison with the directory of today. It contained 1474 names, grouped alphabetically by the first letter only. While he selected some representative citizen to head each letter, as "Adams Samuel, Hon. Winter-ftreet" or "Hancock John, Efq; Governor, Beacon ftreet," the rest simply took their chances, and even the world-famous Paul Revere appears as a simple "goldfmith," half way down the "Rs."

One effort was evidently enough for Norman, as the next directory was issued by John West, a bookseller, in 1796. He sponsored several editions, and was followed by a number of other publishers at irregular intervals, until Charles Stimpson, Jr., a bookbinder, began the annual publication in 1820.

In 1846, George Adams, who apparently decided that the business of hatter in which he was engaged, was altogether too prosaic an occupation for one of his advanced ideas, entered the directory field, and introduced a number of innovations including a classified business section, and much miscellaneous information, not previously found in directories. From the first issue it is learned that Boston had "twelve acres daily of newspapers, 811 trees on the Common, 2,000 people arrive and depart daily by trains. About 15,774 families do their own household work; etc." Adams' work evidently "scooped" the field, for the next year Stimpson sold him his interest in the directory.

Not only did the new owner prove a genius for organization and system, but it appears he was considerable of a local "pooh-Bah," inasmuch as for years he had charge of the work of numbering the streets, enrolling the militia, recording the schoolchildren, and enumerating the local census.

His introduction of the classified business directory laid the economic foundation for the modern directory, making it "The common intermediary between buyers and sellers." Wendell Phillips wrote of him, "he may be said to have created the system of directories, which he extended over this whole section of the Union; with rare enterprize and consummate skill, systematizing the whole business, till it ministered in a most unexpected degree, to the convenience of the whole North."

The history of the Sampson-Murdock Company from its founding by George Adams, is typical of many New England concerns. Young men entered the business, worked up, were admitted to partnership, left their impress on the product, enhanced the good-will, and passed on.

In 1846, George Sampson entered Adams' employ, and was admitted to partnership ten years later, when the business was carried on as Adams, Sampson & Co.

In 1863, Orlando H. Davenport, who had been employed by the concern for several years, became a partner, but the firm name was not changed until after Mr. Adams' death, when it became known as Sampson, Davenport & Co., in 1866.

William E. Murdock, who commenced directory work in 1866 after his discharge from military service in the Civil War, became a partner, and upon Mr. Davenport's retirement in 1884, the name was changed to Sampson, Murdock & Co. The company was incorporated in 1903, as the Sampson & Murdock Company, with Mr. Murdock as president, in which position he continued until his death in 1918.

In 1867 Charles D'W. Marcy entered the employ of the firm, and was admitted to partnership in 1883. Upon the incorporation of the company

he became its treasurer, was elected president in 1918, and served in that capacity until his death in 1925. He was followed by his son, Grosvenor D. Marcy, the present president, who had entered its employ in 1907, serving in successive capacities as canvasser, office assistant, secretary, assistant treasurer, treasurer, and president.

The business has been expanded to include city directories for fifty cities in New England and in New York state. The New England Business Directory has been issued by the concern regularly since 1852. This is a complete business publication of the six New England states, with a separate section for each state, and containing over 300,000 listings. In addition to complete data under the classifications, much more detailed information is carried relating to the larger manufacturing concerns.

A more recent addition to the company's list of publications is the Directory of Massachusetts Manufacturers, undertaken at the suggestion of, and compiled under the editorial supervision of, the Associated Industries of Massachusetts. This volume gives detailed information concerning all manufacturers in Massachusetts, the data being arranged alphabetically, geographically, by classification, and by trade name of products. It may be said to serve as a condensed and coöperative catalog to promote the knowledge and use of Massachusetts products.

The company also publishes the Boston Blue Book, House Directories of several cities, and many street guides and maps.

In general, it may be said that the business of the concern is to gather, compile and publish information about people, places and things; to facilitate personal and business intercourse, and thus promote the prosperity of the territory covered. Its long and successful life would indicate that it has served and is serving a useful purpose.

The corporation has capital of \$40,000, and employs 175 operatives. Grosvenor D. Marcy is president, A. Hutchins, secretary, and Ernest E. Gambles, treasurer.

THE GLOBE LOCOMOTIVE WORKS

In 1846, John Souther, who had been identified with the Boston Locomotive Works for six years or more, and who made the first locomotive models and patterns for Messrs. Hinckley and Drury, of that concern, began the manufacture of locomotives, at the corner of A and First streets, in Boston, with capital of \$2,000, in company with J. Lyman, whose interest he shortly afterwards purchased. In seven years, Souther built the business from an annual production value of \$40,000 to \$326,000. In June, 1854, he incorporated the enterprise under the name of the Globe Locomotive Works, and became president of the concern. In addition to this plant, Mr. Souther had, at the same time, full supervision of the mechanical department of a large locomotive concern, in Virginia, in which he owned a half-interest.

D. N. Pickering was the acting treasurer of the Globe Corporation, having previously held the position of master mechanic of the Boston & Worcester Railroad Company the predecessor of the Boston & Albany road. Subsequently he was general superintendent of several railroads that were later projected and built.

George Souther, a young brother of John, became general manager of the Globe Locomotive Works, and contributed several important inventions upon which he obtained patents, these improvements being used

on the Globe locomotives. Between 1854 and 1864 the concern produced between twenty and thirty locomotives each year. Following a disastrous fire in 1860 locomotive building was largely superseded by the manufacture of steam shovels, and sea dredgers, the Russian and Egyptian governments being among the company's customers for both the iron ships and the dredgers built by the works.

During the Civil War the concern was largely engaged in government work, building the U. S. Steamship *Housatonic*, and the hull and machinery of a monitor, as well as the machinery for a sloop-of-war and two side-wheel steamers ordered by the U. S. Government. Frequently the force at the Globe Works numbered as high as 600 men. The company also manufactured stationary engines and sugar mill machinery.

Messrs. Chubbick and Campbell established an extensive stationary engine and boiler works plant, in Roxbury, in 1846 which within ten years thereafter had a capacity of fifty engines per year, ranging from three to 100 horse-power, together with boilers, all kinds of heavy mill machinery, rubber machinery and the like. They purchased the machine shop which had been set up in Roxbury, by J. C. Pratt, early in that decade, and Chubbick fabricated the first tubular boiler ever made in the vicinity of Boston.

The first American manufacturer to produce that type of leather known as French calf was George Brooks, who founded the Boston firm of Brooks & Co. In 1846, he began the manufacture of this commodity, after having spent a year in France, where he acquired knowledge of the process.

H. P. HOOD & SONS, INC.

On October 17, 1929, the mammoth new milk plant of H. P. Hood & Sons, at 500 Rutherford Avenue, Charlestown, was first opened for public inspection. The structure is of reenforced concrete and fireproof construction, and contains 90,000 square feet of area, not including 15,000 square feet of office space, and the equipment installed has a total capacity to care for the pasteurization and bottling of 300,000 quarts of milk daily, as well as 20,000 quarts of cream. Upwards of 200 tons of refrigeration are used each day and the plant has 1,000 horse-power motor equipment.

The plant cares for the milk produced by the 50,000 cows that serve the Hood Company, and the commodity, delivered to thirty-nine country milk receiving stations, is brought to the plant for treatment and bottling, as well as cream from seven country cream stations. The butter department has a capacity of 30,000 pounds per day.

All cream is pasteurized, cooled and goes to holders where it is blended into light, heavy or medium types. The fat-free milk is also pasteurized, cooled and sent to the buttermilk department, where it is put up in cans for use in bakeries and other plants. To fresh fat-free milk a scientifically pure butter-milk culture is added.

For family milk there are two complete pasteurization units with a capacity of 15,000 quarts an hour. Each is doubly protected with a dual electric temperature control. The raw milk passes over the outside of a regenerator, then through a heater where it is heated to 144 degrees Fahrenheit, then to a holder where it is held at that temperature for thirty minutes, next through the regenerator unit to the cooler where it is

chilled to thirty-eight degrees, and then to a glass-lined supply container which maintains a constant supply for the automatic bottle fillers.

The laboratory is one of the most completely equipped units of its kind in the country and is responsible for checking the quality of the milk through every step of its production, transportation, processing and delivery. When the milk is received at the plant, that of each producer is weighed separately and a sample taken for richness. As an incentive to the producers, the Hood company pays graduated, quality premiums, thereby encouraging the production of richer and cleaner milk.

The plant is equipped with twenty-one glass-lined insulated containers, by far the most sanitary method yet contrived of transporting milk from country to the city. Those used by the Hood company represent three-fourths of all there are in operation in New England. Each has a capacity of 12,000 quarts.

There is a complete separate unit for Grade A milk, which has a special bottle washing machine with a capacity of 120 quart bottles a minute. Each bottle is automatically brushed inside and outside and it passes through eight distinct processes, requiring twenty-two minutes of time, during which it is sterilized and the bottle cooled to the same temperature as the milk.

The general office has twelve different departments working at full efficiency.

The new plant combines the best in dairy engineering, as found by Hood engineers who searched the country for three years preparing for this plant. A feature is the complete laundry and tailoring department, which provides every plant employee with a clean, laundered suit each morning.

The chemical and bacteriological laboratory is equipped for 250,000 tests per year and the entire plant is so constructed that it can be flushed with water and live steam at the end of each day's run. It represents the culmination of eighty-three years of service to the public and typifies the spirit that has actuated the progress of this New England owned, operated and managed concern, which is now directed by the second and third generations of the founder's family.

Erected on a site which has been occupied by the company since 1900, the new building covers a frontage on Rutherford Avenue of 187 feet and extends back to a depth of 300 feet.

The corporation has capital of \$4,500,000 and employs upwards of 2,700 men and women. C. H. Hood is president; G. H. Hood, vice president; G. H. Hood, Jr., secretary and H. P. Hood, II, treasurer.

L. C. CHASE & COMPANY

The partnership of L. C. Chase & Co., has its Boston headquarters at 89 Franklin Street, just a few minutes walk from the site of its first office, which was opened in 1847, on lower Washington Street under the direction of two brothers, Lucius C. and Henry Chase.

At that time the firm was engaged in manufacturing saddlery, horse clothing, blankets, and like products which had widespread popularity and which were carried by the company's salesmen to all parts of the United States then open to travel.

Having successfully established this line of merchandise it was natural to look for expansion, and in 1867 the partners became interested in the

development of a group of mills at Sanford, Maine, founded by Thomas Goodall, and as part owners of these plants L. C. Chase & Co., began operating as mill representatives, selling as commission merchants the Sanford Mill's mohair plush fabrics for robes and upholstery purposes.

Larger Boston quarters were taken and L. C. Chase & Co., became selling representatives for other New England textile mills and allied interests.

The products of these plants are now sold throughout the world by the Boston firm:—Sanford Mills B, Sanford Mills C, both at Sanford, Maine, the world's largest producers of mohair pile fabrics; Sanford Mills L, located at Reading, in this state, which manufacture a superior, artificial leather; the Reading Rubber and Manufacturing Company, also at Reading, producing fine automobile deck materials, rubberized fabrics and water-proofed textiles, and the Troy Blanket Mills of Troy, N. H., makers of wool and wool mixture cloths for coat-lining and blankets.

All commodities manufactured by these mills bear as part of their trade name the "Chase" symbol, which is the registered trade-mark identifying all products sold by L. C. Chase & Co., and include—Chase Velmo Upholstery Velvets, Chase Drednaut Deck Covering, Chase Robes, Chase Steamer Rugs, Chase Leatherwove, Chase Furwove Fabrics, etc.

During the World War, L. C. Chase & Co., operated a large factory at Watertown, in this state, where government orders were executed.

The Chase organization numbers over 120 men and women. The main headquarters are in Boston, with branch offices in New York, Detroit, Chicago, San Francisco, and an elaborate exhibit room, at Atlantic City, N. J.

The present partners in the enterprise are: Olindus M. Kendall, Frank B. Hopewell, William P. Underhill, John E. Nelson, James Clemens, William H. Mertz, Henry C. Hopewell, and Frederic C. Hopewell.

HARRISON LORING—THE FIRST LOCAL BUILDER OF IRON STEAMSHIPS

In 1847, at the age of twenty-two years, Harrison Loring, a native of Duxbury, who served his apprenticeship with Jabez Coney, of Boston, established The City Point Works, in South Boston, where he bought a 600-foot frontage on the harbor, took over the structure formerly used by the city as the "House of Industry," a building of unhewn granite, four stories high, and 300 feet in length, and began the manufacture of stationary and marine engines and boilers, sugar and paper mill machinery and iron light houses.

Among the first to foresee the approaching demand for iron sea-going steamships, he applied to the city for permission to buy its "House of Industry," and promptly met with strenuous opposition from a group of Boston capitalists, but finally succeeded in his quest. His was the first iron ship-building enterprise permanently established in New England, and in 1857-8 he built for the Boston and Southern Steamship Company two iron steamers, of 1,150 tons each,—the *South Carolina* and *Massachusetts*, which were completed and delivered on the very day named in the contract, and which afterward were sold to the United States Government, and used in the blockading squadron on the southern coast, during the Civil War.

Later, he built for the Union Steamship Company of Boston two iron

screw steamers, the *Mississippi*, and *Merrimack* of 2,000 tons each; provided machinery for sloops of war, side-wheel and screw propellers for the government during the Civil War, and built the monitors *Nahant*, and *Canonicus*—the former being the first vessel of its type ever turned out at a New England yard.

Frequently, Mr. Loring employed between 500 and 700 skilled artisans.

SOME BOSTON PUBLISHING HOUSES OF THE FORTIES

John P. Jewett, son of a clergyman, having acquired a practical knowledge of the book business, started in the publishing business, in Boston, in 1848 at the age of twenty-one years, with a total capital of \$50 and hired a shop which had been occupied by cabinetmakers, remodeled it, and began placing upon the market theological, moral, agricultural and miscellaneous works, including the lectures of Henry Ward Beecher, and Harriet Beecher Stowe's story, "Uncle Tom's Cabin." Forty thousand copies of "Shady Side" were printed and sold the first year after publication, and the same number of copies of "The Lamplighter" in the first two months after the volume appeared on the market. In the early days 500 copies was a large edition of a new book. In 1827 to 1837 the ordinary sale of a successful volume was from 1,000 to 1,500 copies, and not until about 1850, were 10,000 copies of an edition printed.

"Uncle Tom's Cabin" had reached a total sale of 295,000 by 1855; Prescott's works, 160,000; Freedley's "Treatise on Business in England and America," 108,000; "Leslie's Cookery," 96,000 and "Fern Leaves," 45,000.

Sanborn, Carter & Bazin, located at 25-29 Cornhill, succeeded B. B. Muzzey. This firm was a union of the Portland, Maine, firm of Sanborn & Carter and the Muzzey concern, and engaged in printing, binding, publishing and wholesaling. It had a capacity of 10,000 ordinary sized books and made a specialty of school text books, encyclopedias and was reputed to have issued the best American edition of the Waverly Novels up to that period.

The firm of W. J. Reynolds & Co., composed of William J. Reynolds and Frederick A. Brown, occupied five floors at 24 Cornhill, for more than a quarter of a century, beginning in the late thirties and made a specialty of school and comic books. Colburn's "First Lessons in Arithmetic" reached into the millions, while Worcester's "Elements of History," a text book then used in Harvard University, and Smellie's "Philosophy of Natural History," were among the leading school books published by that house. "The American Vocalist," issued by the company, reached a total sale running into the hundreds of thousands. In the field of miscellaneous literature, Jacob Abbott's "Rollo's Tour in Europe," in six volumes, proved a great seller.

HOUGHTON, MIFFLIN & COMPANY

In 1849 Henry Oscar Houghton, who came to Boston from his native state of Vermont, to become a cub reporter on the Boston *Traveler*, formed, with one Bolles, the printing company of Bolles & Houghton, which began business on Remington Street, in Cambridge. Soon after acquiring some of the publications of Little, Brown & Co., the Cambridge firm became tenants of Charles C. Little, in a building located adjacent

to the Charles River front. Seeking a name for the company, Mr. Little suggested that they style themselves as The Riverside Press.

At that period the old Corner Book Store, on Washington Street, Boston, was passing through the stages of reorganization, the original firm of Carter, Hendee & Co., becoming Allen & Ticknor, William D. Ticknor, William D. Ticknor & Co., Ticknor, Reed & Fields, before finally being known as the famous house of Ticknor & Fields. In 1865 the retail end of the business was sold to E. P. Dutton & Co., now of New York, and Ticknor & Fields moved to Freemont Street, where they gave their attention solely to publishing. Upon the death of Mr. Ticknor the firm became Fields, Osgood & Co., and, in 1871, James R. Good & Co. Mr. Osgood sought a printer who would handle his publishing business and interested Houghton who had formed a partnership with Melancthon M. Hurd of New York, and who was then conducting a printing business under the name of Hurd & Houghton. In 1872, George H. Mifflin became a partner, and Hurd retired from the firm six years later, at about the period that Osgood entered into negotiations with Houghton & Mifflin, the original letter heads of the firm appearing as Houghton, Osgood & Co. When Osgood retired in 1880, the concern became Houghton, Mifflin and Company, which was changed to the Houghton, Mifflin Company when it was incorporated.

Henry O. Houghton died August 25, 1895, and later H. O. Houghton, his son, became a member of the concern and at about this time the corporation acquired the old Quincy Mansion, at 4 Park Street, Boston. In May, 1923, the concern moved its headquarters to the present location, at 2 Park Street.

The Houghton, Mifflin Company has acquired an enviable reputation as a publisher of fine literature. Early in its existence the executives announced that they would not confine their output to local authors; that they would be neither narrow nor provincial in effort; that they would retain the fine traditions which they had inherited from their predecessors; and that modern tendencies in publishing, if not mere fads, would find them abreast of the times.

The present officers are: president, Edward R. Houghton; vice president and treasurer, James Duncan Phillips who with Albert F. Houghton, George M. Mifflin, Benjamin H. Ticknor, Ferris Greenslet, Henry A. Laughlin, Stephen B. Davol, Nathan T. Pulsifer, Franklin S. Hoyt and Roger L. Scaife constitute the board of directors.

In its Cambridge factory, and its Boston office, the corporation employs upwards of 900 men and women, and it has capital of \$2,580,000.

THE CARPENTER-MORTON COMPANY

Ninety years ago Eleazer F. Pratt opened a little paint shop on Broad Street, Boston, where he ground paints in a hand mill, and where he continued to prosper as at that period Boston was the big port for ocean-going vessels, and the demand for marine painting was extraordinary. A year later Pratt moved to 107-109 State Street, where the shop remained for thirty years. For a short time, in 1872, it was located at 77 Clinton Street, and also at 99 Milk Street, and for a longer period the headquarters were at 151 Milk Street. In 1849 George O. Carpenter became a partner and the concern was then known as Banker, Crocker & Co., which in 1863, was changed to Banker & Carpenter. In 1860, John D. Morton entered

the employ of the company as a bookkeeper, and was admitted to the firm three years later. About that period E. T. Woodward and Isaiah Woodbury became partners, and the firm was known as Carpenter, Woodward & Morton. Occasional changes in personnel took place until 1892 when the business was incorporated under its present name—the Carpenter-Morton Company. With this foundation of rugged maturity the concern in its partnership and corporate forms successfully weathered the trying financial panics of 1857 and 1861; a fire which all but wiped out its State Street plant, in the latter year; the strenuous periods of the Civil War and the Boston fire of 1872, followed by the financial troubles of 1873, 1893 and 1907 and during the past quarter of a century has shown rapid and continuous expansion. It was in 1885 that the company began to manufacture varnish stains, a novel product at that time, designed for staining and varnishing with one operation, furniture, woodwork or floors.

Before the discovery of this article, when one desired to change a piece of furniture from oak color to a mahogany finish or any natural wood shade, it was necessary to remove the old finish, then give the wood a coat of oil stain and finally two coats of varnish.

These products were originally marketed under the name of Campbell's Varnish stains, but in 1919 were renamed "Carmote Varnish Stains," inasmuch as the word "Carmote" had been adopted for the trade-mark of the entire line of varnishes, enamels, stains and finishes.

About 1892 the company found that manufacturers of straw hats were buying a quick drying colored varnish for finishing women's hats. The thought occurred to the executives of the company that the product would also be found useful by millinery stores, and it was marketed in bottles and sold under the name "Colorite Straw Hat Finish." The company soon discovered that the outlet for this product was the retail drug store, and today it is sold in more than ninety-eight per cent of the drug stores in the United States and in thousands of others throughout the world.

Since 1898 the executive offices have been located in the Sudbury Building, 77-79 Sudbury Street, Boston, with the factory on Atlantic Avenue until 1909. That year the company purchased land in Everett and built a modern plant. Changes in manufacturing methods in the paint and varnish industry have been many in recent years. The company has always kept abreast of these by making improvements which would enable it to produce by latest and most approved methods.

In 1923 the Carpenter-Morton Company built a stackless varnish plant, the first of its kind in New England and one of the first three in the country. Greater uniformity in output is possible through the cooking of the varnish gums by this method.

The Carpenter-Morton Company is a New England institution, financed by New England capital and entirely independent of other organizations. Its business has been built by manufacturing paints and varnishes of highest quality and by rendering prompt and efficient service to its thousands of customers.

The president and general manager, George C. Morton, has been connected with the corporation since 1886. A. I. McLauthlin is vice president, William E. Gilmour, treasurer, M. L. Foss, secretary, and John W. Campbell, assistant treasurer. The concern has a capital of \$1,000,000 and gives employment to 160 persons.

THE A. T. STEARNS LUMBER COMPANY

For more than eighty years the A. T. Stearns Lumber Company has been providing New England with a complete service in woodwork, for it was in 1849 that the concern was founded and it has operated continuously since that year.

In its extensive plant, at Neponset, where the finest of harbor facilities are afforded, and access to which is obtained direct from the Atlantic ocean, upwards of 200,000 feet of flooring can be subjected to the drying process at one time, while from 75,000 to 90,000 feet are carried under heat at all times.

The corporation constantly has in stock over 6,000,000 feet of California, Idaho, Arkansas and North Carolina pine, as well as Long Leaf Yellow, Tupelo, sap and red gum, hemlock, ash, spruce, oak, mahogany, birch, maple, cypress and redwood types of lumber.

The company's door factory is equipped to manufacture any type of door from the smallest cupboard size to those thirty-feet square. In the large carpenter shop columns, brackets, mantles and bookcases are produced, and the company has complete facilities for the manufacture and installation of greenhouses and round, rectangular and oval wooden tanks.

Its modern tank factory is equipped with the latest machinery for this type of production, and it has turned out hundreds of box tanks ranging from a capacity of twenty-five gallons to 30,000; round tanks of from twenty-five to 125,000 gallons, as well as half-round and special tanks, fitted with partitions and agitators, for chemical and other plants.

The company has manufactured and installed for pulp mills in the United States and Canada, a type of tank, or tower, over 100 feet in height, and innumerable pen-stocks of unlimited lengths, and has furnished immense quantities of lumber for flumes, dams, and other structures in and about water-power plants.

The window, blind and glazing departments carry regular size windows and blinds in stock, and in addition to framing lumber, rough and finished boards, gutters, conductors, interior and exterior mouldings, the corporation specializes in cypress and redwood for interior and exterior finish.

The concern is the distributing agent for many nationally advertised products such as Upson Board, Gypsolite, Celotex, Breinig Bros. paints, Bird's roofings, Insulite, and the Morgan wood-working specialties.

The main office of the corporation is at Neponset, but it maintains Boston headquarters, at 1 Sudbury Street. It has capital of \$150,000 and employs upwards of 250 operatives. Frederick R. Moseley is president, Roland D. Stearns and A. Maynard Stearns, are vice presidents, Edward S. Tenney, clerk, and Henry B. Barham, treasurer.

OTHER BOSTON ENTERPRISES OF THE DECADE BETWEEN 1840-1850

In 1849, Cutter, Towle & Co., of Boston, began the manufacture of gold pens, succeeding the original firm of C. A. Haskins & Co., which had commenced operations three years before. The new firm employed fifty operatives in producing gold pens, round, octagon and drawing pencils, erasive pencils of graded numbers adapted to bookkeepers use and mechanics and ship carpenters' pencils.

In 1849, Messrs. G. P. and E. B. Gordon, under the firm name of

Gordon & Co., purchased the business of Mr. Whiton, who began the manufacture of silverware in Boston, in 1819.

The decade of 1840 to 1850 witnessed the march of local industry to greater heights, and some of the enterprises not previously enumerated included the Sturtevant Linseed Oil Works, which were established at East Boston; the American Flint-Glass works, which began operations at South Boston; the Mt. Washington Glass Works, Henry S. Washburn's Wire Works, the Suffolk Lead Works, and the plant of the Bay State Iron Company.

It was during this decade that John Batchelder, of Boston, invented an automatic feeding device for Elias Howe's sewing machine, while Messrs. Blodgett and Lerow, also of Boston, invented a rotary shuttle for use in making the lock-stitch.

It was also at this period that Uriel A. Boyden, of Boston, invented his turbine water-wheel, which effected the utilization of seventy-eight per cent of the power of the water, the first wheel being installed in Lowell.

THE E. HOWARD CLOCK COMPANY

For centuries following the settlement at Plymouth it was generally agreed that owing to lack of experience, the great skill required and the high cost of American labor, the day would never dawn when the business of watch-making could successfully be carried on in the United States, and there seems to be little doubt that had it not been attempted by two ingenious, enterprising and confident Massachusetts mechanics—Aaron L. Dennison and Edward Howard,—both of Boston, this industry, now so



EDWARD HOWARD
of Boston

Manufacturer of the celebrated Howard watches and clocks, and one of the founders of the present-day Waltham Watch Company

important in this country, would not have been inaugurated until many years after it was begun by them. They were typical of many other Bay State inventors and entrepreneurs in that they would not listen to the remonstrances of their friends and associates, nor the ridicule of the scoffers, but on the contrary persevered until their efforts were crowned with success. Their introduction of machinery into watch-making solved the problem. Dennison had long been a skilled watch-repairer and both he and Howard had learned their trade of clock-making under the tutelage

of the celebrated Willards. For two years they carried on experiments and, in the summer of 1850, associated themselves with Samuel Curtis, of Boston, and erected at Roxbury a brick factory 100 feet in length, 25 feet in width, two stories in height, their intention at the time being to confine the production to eight-day watches. Only fifty were made before it was found that reliable time could not be obtained from an eight-day watch and they centered production on a thirty-hour type of time-piece, 1,000 being marketed while the concern was known as the Warren Manufacturing Company. The name was then changed to the Boston Watch Company, and the business was carried on at Roxbury, until 1854, when it was removed to Waltham, where a large factory in the form of a hollow square, 100 feet on each side, two stories in height, was built and occupied until 1857,—the predecessor of the Waltham Watch Company—when financial troubles resulted in the assets being sold at forced sale for the benefit of creditors. Mr. Howard returned to the original plant, at Roxbury, which he subsequently enlarged and where he introduced a new style of movement, a stem winder, in place of a key and where the business of manufacturing clocks is still carried on, under the name of the E. Howard Clock Company. The executive offices and plant are located at 206 Eustis Street, Roxbury, while the sales offices are at 387 Washington Street, Boston. The corporation has capital of \$250,000 and employs eighty skilled artisans. Edward A. Bigelow is president and general manager, William J. Elton, vice president and treasurer, and Henry G. Bigelow, secretary.

Prior to engaging in the business of watch-making, Howard had conducted a business at 43 Cornhill, Boston, under the firm name of Howard & Davis, whose astronomical and office clocks and gold-standard balances had gained an unsurpassed reputation throughout the United States.

GOLD PENS, PRINTING AND HORSESHOE NAILS

George Stimpson, Jr., formerly of the Merchants Bank of Boston, was one of the earlier inventors of gold pens, his product being placed on the market about 1850 under the trade name of "Ionic." He received five medals and nine diplomas from various Institutes on his invention, while Daniel Webster testified that his product was the only metallic pen he had ever been able to use.

The Franklin Printing House was located in the early fifties of the last century on Washington Street, later removing to larger quarters on Franklin Street. One of the most ambitious contracts of this firm was a 1,100-page volume, "The Laws of California," which was set up and printed in the short space of six weeks, while three other works, one of 400 pages, were completed in the same period.

In 1850, Silas S. Putnam, of Neponset, conceived the plan of forging horseshoe nails by machinery from a red-hot rod, but like many inventors he experienced the greatest difficulty in having his product accepted by the trade. Blacksmiths were prejudiced against a machine-made nail, and in many instances refused to use Putnam's products, even when given to them, but the Civil War proved a great bonanza to the inventor, as the Putnam nail was officially endorsed by the War Department after rigid tests. Hundreds of tons were bought for the cavalry and artillery arms of the service. Mr. Putnam set up a large factory on the Neponset River, within the Boston area, installed a 200-horse-power Corliss engine, and

employed 200 operatives, requiring annually in the manufacture of his nails 1,000 tons of Norway iron and 80,000 wooden packing boxes in which to ship his products.

As early as 1860 thirty-three tons of nails were manufactured by the Putnam Nail Company and by 1893 the daily production had grown to ten tons, while the concern then employed between 400 and 500 operatives.

THE DWINELL WRIGHT COMPANY

The Dwinell Wright Company dates from 1850 when James F. Dwinell, a native of New Hampshire, purchased for \$300 an interest in a coffee-roasting establishment, in Boston.

The progress of this corporation in the intervening eighty years to an enterprise that today commands the use of capital amounting to \$1,000,000 proves what New Englanders do with ideas.

The Dwinell Wright Company employs upwards of 250 operatives at its 311 Summer Street plant where its coffees are roasted and its teas are tested. It is one of the largest Boston importers of these commodities and long ago took its place in the forefront of the local concerns which have made Boston the American center of coffee importing, roasting and marketing. George S. Wright is president and treasurer, and Warren M. Wright, secretary of the corporation.

"EXCELSIOR"—A MASSACHUSETTS PRODUCT

The origin of many essentially American commodities is filled with oddities, and perhaps none more so than in the accidental discovery of the product of wood-fibre, known to the trade and to the world, as "excelsior," now so generally used in packing and shipping articles, as well as for a filling for the cheaper grades of mattresses.

Jonathan Prescott, of Roxbury, chanced one day to pass a blind man, who was engaged on the veranda of his home in filling a bed-tick with fine whittlings of wood, and immediately there flashed through his mind the thought that here lay the germ of a product of economic and utilitarian value. He designed, patented and constructed a machine for reducing wood to a thread-like substance, and entered the market as a manufacturer of excelsior.

But success did not reward these initial efforts, and he sold the patent to William Blanchard of Dorchester, who proved to be a better salesman than Prescott, and who, after some difficulties, discovered a moderately profitable market in the South. After a trial of all the woods grown in New England, Mr. Blanchard found that poplar best filled the requirements of his manufacture, as the shredded excelsior retained its elasticity longer when fashioned from this wood than from any other. He established a factory at Fisherville, in this state and another in East Tilton, N. H., and was soon selling 3,000 tons of excelsior annually to furniture, mattress and other manufacturers.

THE MORANDI-PROCTOR COMPANY

Since 1851 when Francis Morandi began the manufacture of tin and copper ware, and kitchen goods of all varieties, the Morandi-Proctor Company has devoted its efforts to serving New England needs, and with every

member of the present-day enterprise having been born and reared within the geographical limits of the six Northeastern states, the concern well deserves the slogan, which it invariably employs over its display booths at all expositions where it exhibits its sterling products—"The 100% New England Firm."

New England hotels, colleges, hospitals, clubs, cafeterias, restaurants and institutions have shown a particular pride in doing business with this house that has brought forward during the past few years some of the most progressive ideas and up-to-date pieces of cooking apparatus of any enterprise of its kind in the United States.

The company's executives have made a specialty of rendering personal service to its customers, a policy which often has been a deciding factor in securing large contracts.

Soon after the formation of the original concern the founder admitted his son, Ernest L. Morandi, to the partnership, and the latter proved so skilled a salesman that it was soon feared the contracts secured by him could not be filled within the required time with the limited manufacturing facilities then possessed by Francis Morandi & Son, and the firm immediately acquired the going business of E. Whitely & Co., which was operating in the same field.

Following the death of the founder, Ernest L. Morandi consolidated the business with that of the Smith & Anthony Company and was retained by that corporation as manager of the hotel department, until 1905, when, with Charles F. Proctor he purchased the hotel department business of the Smith & Anthony Company and of the Walker Pratt Company of Watertown, and the Morandi-Proctor Company was incorporated.

In 1906 A. Morandi Bartlett entered the employ of the concern as an errand boy and through close application to business and his interest in the firm and its high ideals worked his way to the treasurership of the corporation.

Arthur H. Boynton, the president, has been associated with the old and new firms for thirty-three years, and he is also president of The National Association of Kitchen Equipment Manufacturers.

Other representatives of the firm are James B. Meehan, a member of the board of directors, and Nathaniel W. Aldrich who carry on the engineering activities and the planning of kitchens; and W. P. Hatch, vice president who has charge of the sales rooms which are handled by Chas. J. Greer and Henry Coleman. C. C. Chesley is in charge of the territory in Maine and F. H. Griffin is the Vermont and New Hampshire sales manager. F. H. Colton is the Rhode Island representative and specializes in hospital supplies. John Murphy and Samuel B. Smith are the Boston representatives and Francis Walsh covers the district from Newburyport to Worcester.

The company's sales in 1928-1929 showed a sizable increase over those of former years. Between seventy-five and 100 hands are employed by the corporation.

THE JORDAN MARSH COMPANY

When Eben D. Jordan, Sr., a penniless, fatherless fourteen-years-old farmer boy, born in Danville, Me., stepped off the gang-plank of a Portland steamer that entered the Port of Boston in 1836, it is doubtful if he then dreamed of the enterprise he was to found with Benjamin L. Marsh,

and whose reputation would expand into every land under the sun where industry and commerce hold sway.

But the year 1841, when he was nineteen years of age, found him in business for himself, on Hanover Street, and just ten years later, with Mr. Marsh as a partner, and a joint capital of \$5,000 the first Jordan Marsh store, was opened at 129 Milk Street, where a jobbing business was carried on. Mr. Jordan stated in after years his "idea of success is to create something needed, and give employment to a lot of people," and here was the germ of the altruism that was a dominant factor in his character.

He believed that New England made and sold better things and had as much if not more reliability, than any other part of the country. He was a New Englander to the manor born, and the business has always been managed by New England people. The bulk of the 5,000 employees now on the payroll of the concern are New Englanders and New England integrity is the corner-stone of the business.

Perhaps there is no outstanding point in the Jordan Marsh Company's amazingly successful career so great as this latter fact. It was selected by President Coolidge in his telegram congratulating the firm on the occasion of its Diamond Jubilee in 1926 when he wired that "the example of Jordan Marsh Company business integrity is not only community-wide but reaches out into the general business fabric of the country."

From the modest 1851 beginnings, flowed the great expansion of today. The corporation occupies two entire city blocks, the old firm moving several times into enlarged quarters to carry on its wholesale business and finally, in 1861, opening a retail store at the present location at the corner Washington and Avon streets, which it purchased from George W. Warren & Co.

Eben D. Jordan, Senior, died in 1895, and Eben D. Jordan, Junior, became head of the company. E. J. Mitton for many years active in the management, served as vice president up to the time of his death in 1913. His son, George W. Mitton and Walter F. Watters, then became vice presidents, and George W. Mitton succeeded to the presidency upon the death of E. D. Jordan, in 1916.

The present officers are, George W. Mitten, chairman of the board of directors; Richard Mitton, president; Ralph C. Hudson, executive vice president and general manager, and Maurice Wrigley, treasurer.

Exclusive of the Cambridge and South Boston plants, the retail business occupies upwards of twenty-four acres of floor space. The corporation is the largest purchaser of manufactured commodities in New England, and it has more European buyers than any department store in the United States.

The relations of the employees to the corporation are cordial and co-operative, and are cemented by more than three-quarters of a century of mutual advantage and helpfulness. Practically all buyers and department heads have grown up in the store. No employee is allowed to be discharged after three years of service without the personal investigation and assent of the president of the company, and old employees are pensioned. Profit sharing, bonus selling, education for efficiency, health and recreation provisions, sickness and disability protection, and protection from loan sharks are a part of the activities of the Jordan Marsh Company. There are 323 members in the corporation's quarter-century club

and nine in the half century, a fair token that the health of its employees is not least among the concerns of the management of this old New England enterprise.

When, in 1909, the company completed its then new annex building, 222 feet long by 135 feet wide, with nine stories above the ground and two below the street level, it was felt that there would be little need for extension for some years to come, but in 1910 the corporation opened its basement store, under the entire main store and annex, and added 120,000 more square feet to its facilities.

In 1922 the physical plant was further enlarged when the business of A. Shuman & Co., at Washington and Summer streets, was taken over, and the building, formerly known as Shuman's Corner, was added to Jordan's business. In the same year the South Boston warehouse, containing 250,000 square feet of space, was first occupied for storage and manufacturing purposes.

Other improvements and extensions in recent years include the company's service garage, with 24,000 feet of floor space, on Harrison Avenue; the addition of two floors to the building occupied by the furniture department and the Shopper's Garage, primarily for the use of Jordan Marsh Company customers, opened on Beach Street, in 1926.

The latest development was the purchase of the so-called (five-story) Gray & Davis Building, on Memorial Drive, Cambridge, 365 feet in length, built in 1914, and to which eighty-foot additions were made at the rear, in 1928, the structure being opened by the Jordan Marsh Company in 1929.

The company's receiving, delivering and garaging service extends around the entire front of this building and along one-third of the rear and is a marvel of service station engineering—the last word in economic efficiency. All the cars of the company are garaged at the Memorial Drive plant. The impressive thing about the service station is its fire-proof construction, its isolation from other fire hazards, its cleanliness, light and pure air features.

Practically everything sold at the Boston store in the smaller merchandise line is trucked to the Cambridge service station and packed in hampers of various colors to designate the contents. The entire first floor of the plant is given over to reshipping these goods, the various express companies transferring their quota directly to their own trucks at the plant.

The entire second floor contains the cold storage plant for furs, with 18,000 square feet of space available, and consists of immense vaults, the whole area being 60 feet by 365 feet, and 20 feet high, this being the height of all five stories. The capacity of the fur-storage section, and the scientific innovations introduced to make it a perfect storage place are in alignment with the rest of this modern service station.

The third, fourth and fifth floors are for the storage of merchandise purchased for the Boston store. A restaurant and rest room for the employees of the Cambridge service station, numbering about two hundred and fifty, occupies part of the top floor.

The corporation stands as another example of New England efficiency, and its history gives little evidence of the alleged decline that our critics delight in rehearsing.

In the past five decades its volume of business was increased 1,115

per cent, its retail floor space has grown from 81,000 square feet to 850,000 square feet, or 950 per cent, in addition to which its manufacturing departments, storage warehouses, service stations, and garages occupy 600,000 more square feet.

In 1928 the Jordan Marsh Company entered into a merger of leading department stores by an interchange of stock because its officials believed that the future makes a demand upon the retailing system of the country which can best be met by the merging of a large number of carefully selected stores of representative character.

The Hahn Department Stores, Inc., of which Jordan Marsh Company became an important part, operates leading department stores in all parts of the United States.

George W. Mitton became president of the board of directors of the Hahn enterprise, but the consolidation in no wise changed the personnel of the officers of the Jordan Marsh Company.

THE S. A. WOODS MACHINE COMPANY

Solomon A. Woods, a native of Maine, in 1851 bought the woodworking factory of Solomon S. Gray, in Boston, and devoting himself to the completion of a planing machine which Gray had evolved, but which was



S. A. WOODS MACHINE COMPANY, BOSTON



S. A. WOODS MACHINE COMPANY, BOSTON

not practical in operation, finally so altered its mechanical principles as to make it effective and marketable. On January 1, 1854, Gray & Woods began its manufacture, a patent being granted them on August 22 of that year, while another embodying improvements on the device was given them in 1860.

In 1859 Mr. Gray retired from the firm, and six years later Mr. Woods became the sole licensee of the James A. Woodbury patents on improvements to the Woodworth planer. The S. A. Woods Machine Company, with capital of \$300,000, was incorporated in 1873, but the enterprise really dates from 1851, and therefore takes rank as one of the oldest manufacturers of woodworking machinery in America.

Under the management of Solomon A. Woods it grew rapidly and extended its line of manufacture, and upon his death, in 1907, his son, Frank F. Woods, succeeded to the presidency.

In 1912 the latter sold his interest to H. C. Dodge and the late C. W. H. Blood, the former becoming president of the corporation, and the latter the vice president. The company has for years enjoyed a reputation for making high-grade machinery, and recently has extended its field to include the most prominent lumbering sections in all parts of the world. The Damrell Street plant, in South Boston, is now one of the largest machine shops in New England. Quite recently extensive additions have been made, affording the concern as large a capacity as any unit of its kind in the world engaged in the manufacture of heavy planing-mill machinery. Harry Crane Dodge, president of the concern, began his business career in 1904, as the company's southeastern district salesman, and was made southern manager, with headquarters at New Orleans, in 1908. He became general sales manager, at Boston, in 1911, secretary the same year, and president in October, 1912.

R. Lowe, Jr., is vice president and secretary, and G. M. King is treasurer.

The corporation employs upwards of six hundred operatives in the production of woodworking machinery and induction motors.

THE LEOPOLD MORSE COMPANY

The ready-to-wear industry of both men's and women's goods, including clothing, underwear, millinery and kindred lines, has become one of the largest trades in the United States, ranking among the first half dozen industries in the value of its manufactured product.

The manufacture of men's clothing on ready-made lines was begun in this country about 1845 by William C. Browning, who brought paper patterns from England, from which he cut cloth and made men's suits in regular sizes. The business received its impetus in the Civil War period when large quantities of uniforms were desired in a hurry by the government and immense amounts of blue cloths were made by the mills and manufactured into suits, both for uniform and civilian purposes.

Leopold Morse, the founder of the world famous Boston clothing house of Leopold Morse Company, was born in Bavaria, in 1831, and came to this country in 1848, establishing himself as a peddler of clothes in the small town of Sandwich, N. H. A year later he removed to Boston and secured employment in the clothing store of Henry Herman, who sold his business and moved to New York in 1852. That year the present business of Leopold Morse Company was established and was originally carried on

by Mr. Morse, his brother Jacob, and Messrs. Ferdinand and Louis Strauss. Today, the management resides in Julius C. Morse, a nephew of Leopold Morse, who is president; Leon Strauss, a son of Ferdinand Strauss, who is treasurer, and A. A. Weinberg, a nephew of the Messrs. Strauss.

In 1875 the business was removed to the corner of Washington and Brattle streets, Boston, where it has remained ever since, rounding out over fifty-five years in one location.

In 1904 the company was incorporated as a Massachusetts corporation, and in 1920 the concern leased the building at 217 Friend Street where the manufacturing operations are carried on. In 1923 a branch store was established on Summer Street, and since that year the corporation has become financially interested in locations in other New England cities for the purpose of retailing clothing and men's haberdashery.

The company employs in its model factories about 1,500 workers, and has an output of 3,000 garments a week. One of the large markets for its goods is on the Pacific Coast. It has capital of \$750,000.

Macullar-Parker & Williams, afterwards Macullar-Parker Company, which concern was sold to Rogers, Peet of New York a few years ago, were one of the pioneer Boston houses in the manufacture of men's fine clothing. A. Shuman & Company, which was disposed of to the Jordan Marsh Company several years ago, was one of the original clothing manufacturers, specializing in the manufacture of boys' garments.

Other large concerns that annually manufactured during the '80s and '90s over \$1,000,000 worth each of men's clothing were Whitten, Burdett & Young, Miner, Beale & Hackett, Jas. Rothwell & Co., J. Peavey & Bros., Chamberlin & Currier, now the Talbot Company, and many other corporations. At that time Boston made and marketed clothing valued at between \$30,000,000 and \$35,000,000 annually and this at a period when the garments were sold at about one-third the price of today.

The geographical location of Boston, coupled with numerous labor troubles and the influx of the Russian-Jewish element, which established itself in New York City in large numbers, resulted in the transfer of much of the business to the Metropolis at the close of the last century, and thence to Rochester and Chicago. Yet upwards of \$20,000,000 worth of clothing is made in Boston annually and it is a substantial industry, giving employment to about ten thousand workers.

Boston clothing has always had the reputation of being thoroughly made of the better grade fabrics and by skilled workmen. In fact, a great percentage of the garments manufactured here are the finest produced in this country. Not only the house of Leopold Morse Company, but Scott & Company and other local concerns are manufacturing clothing which is second to none, even in comparison with the best makers of New York, Chicago and other cities.

Julius C. Morse, the head of the Leopold Morse Company, pays this tribute to producers of the textile goods entering into the ready-to-wear clothing industry of the United States.

"While no doubt the mills in and about Huddersfield, England, and many of the Scotch plants produce wonderful fabrics, it is a great question if there are any better cloths made than those manufactured right here in the New England States. The Hockanum Company of Rockville, Conn.; George Mabbett & Sons Company and the Standish Worsted Company,

both of Plymouth, Mass.; the Mayflower Worsted Company, of Kingston, and several plants of the American Woolen Company turn out fabrics which can be favorably compared to those that come from abroad. I have been purchasing woollens, not only in this country, but in England, France, Germany and Austria, for a great many years and I feel that if the truth were written about the textiles made right here in our own New England States, many of them would not only be the equal of the foreign fabrics but in many ways far superior. The Englishman adulterates many of his cloths with cotton and he uses a great many cotton threads in place of silk for decorative purposes but the good New England mills use no adulteration in any form. The colors on the goods made here are just as fast as those manufactured abroad and in fact the blue serge cloths turned out by the American Woolen Company, in Lawrence, or by Metcalf Bros., in Providence, R. I., run more even as to color than the serges we have seen that come from abroad. The only fault that can be laid at the door of the American mills is that they are constantly looking for increased output and manufacture only the type of goods that they can produce in large quantities and as a result novelties are brought out in better shape by both the English and Scotch mills, which not only supply these novelties to the United States but to all the countries of the globe as well."

Much as the average man and woman deprecates and dreads war, history forces us to admit that the bloody and costly struggles of the past have been the causes of advances in industry and commerce that peacetimes seem to have overlooked, and whose beneficencies have resulted in economies to consumers in augmenting the opportunities of labor, in utilizing available capital resources, and in vastly increasing the industrial and commercial productivity of the nation.

So it is with the fourth largest industry in the United States of today, for it was not until Fort Sumter was fired upon in April, 1861, that the world or this country gave any consideration to the ready-to-wear clothing business, which now outranks in the annual value of its products all types of industries save motor vehicles, iron and steel, and meat packing, and it was started by two Boston men, who built a lasting business out of the confusion of the Civil War.

At that period the great middle class relied upon home talent for all but its very best apparel—"Sunday suits," as they were then called. Only the well-to-do Bostonians could afford to purchase their clothing, and there were many measurements and fittings incidental to the purchasing of a suit of clothes.

The tailor called at the home or office of his client and led a miniature parade as he journeyed back and forth from customer to office, for behind him came apprentices with the fabric, the measuring platform and other appurtenances of the trade.

The tailor was of necessity a good conversationalist. During the measuring and fitting he went over the news of the day.

Fifty-one years before the great fratricidal struggle was precipitated between the North and the South there had been opened, at the corner of Washington and Boylston streets, what was known as the Boylston Market—named in honor of Nicholas Ward Boylston—a two-story structure, equipped with market stalls on the street floor, similar to those in the Faneuil Hall and Quincy markets of today, with a hall on the second floor, which was hired by musical and military organizations. The building

was owned by the Boylston Market Association, of which Former President John Quincy Adams was the first president. Among the military groups which drilled in the hall were Companies C and K of the First Massachusetts Regiment, and they were early called to the front. Uniforms were sorely needed and in the emergency the services of Boston tailors were required and freely offered. The measuring was done in the drill hall, and the tailors found they could measure but a few at a time; while the making of the uniforms required many days. The soldiers grew impatient and a uniform designed for John Smith was purloined by John Jones, and, strangely enough it fitted, which incident gave rise to thought. Studying the measurements of the men they had outfitted, the tailors saw that the general proportions of all the soldiers were substantially the same, and they asked themselves why uniforms could not be made up in advance, altered here and there when necessary, and be in readiness for the next draft quota. They tried the experiment, found it worked, and thus the idea of the ready-to-wear clothing industry spread to other centers where soldiers were outfitted, but Boston remained the leading city in this type of production, and its influence was marked. In 1887 Messrs. Freeland & Loomis, then conducting an "emporium" at the corner of Harvard and Washington streets, moved into the most palatial clothing store in the United States, which had been erected for them on the site of the Boylston Street market, and thus established a clothing mart on the very site where ready-to-wear clothing was born, and where the Continental Clothing Company has its present store.

C. L. HAUTHAWAY & SONS, INC.

In 1852 Charles L. Hathaway began business in North Bridgewater, now Brockton, and manufactured Lynn burnishing ink, and North Bridgewater dressing, these two commodities being all that were required by the shoe producers of that era in finishing footwear. From his small shop, where he was the sole employee, Mr. Hathaway delivered his products to nearby customers. Today, the business of C. L. Hathaway & Sons, Inc., is international, the operations requiring a main office in Boston, as well as a five-story factory in this city, two plants in Lynn, one in Montreal, and another in Leeds, England, with branch offices and warehouses in Spain, Italy, France, Germany, Switzerland, Belgium, Denmark, Australia, Japan, China, and South America.

In 1903 the enterprise was incorporated under the laws of Maine, and in 1920 as a Massachusetts corporation. It was in 1854 that the founder admitted his eldest son to the original firm, and that the name of C. L. Hathaway & Son was adopted, which a few years later was changed to C. L. Hathaway & Sons when his younger son, Edwin D., became a partner.

In 1883 Charles L. Hathaway retired and C. M. and E. D. Hathaway, and later F. M., son of Charles M., became identified with the concern, when his father died. E. D. Hathaway retired in 1903 and when his son, Clarence L., finished his college course he was admitted to the firm. F. M. Hathaway died in 1919, and the following year occurred the death of E. D. Hathaway, since which time the active management of the enterprise has been in the hands of Clarence L. Hathaway, who serves as president of the corporation, and who represents the fourth generation of the family. H. Willis is treasurer. Today, the products

include blackings, cements, dressings, tanners' finishes and waxes, and the corporation has capital of \$150,000. Its Boston office is at 346 Congress Street.

H. TRAISER & CO., INC.

In 1852 the firm of H. Traiser & Co., Inc., was founded and for seventy-eight years has been continuously operated by members of the Traiser family, it being the oldest cigar manufacturing concern in New England, and exceeded in age by but one other enterprise of its kind in the United States.

From a modest beginning, with but one or two cigar-makers employed, it was developed by the present treasurer and general manager, Richard E. Traiser, into a corporation employing capital of \$750,000 and utilizing the services of 1,000 operatives.

In 1929 Treasurer Traiser completed fifty years of continuous service with the concern, having entered the business as a boy.

The products of the concern—the internationally known Harvard and Pippin cigars—are distributed throughout this country and abroad.

Charles H. Traiser is president, and Edward E. Facey, assistant treasurer.

THE UNITED AMERICAN SODA FOUNTAIN COMPANY

The beverage popularly known as soda water did not originate in New England, but as early as 1842 Alvin D. Puffer, of Boston, established a bottling business, and ten years later was granted a patent on a cooling device for soda water.

Andrew J. Morse, a Boston coppersmith, invented about the same time a generator of carbonic acid gas, and copper tanks for holding and transporting the gas, thus inaugurating a method of marketing the product which gained popularity steadily.

The first marble soda fountain operated in New England, so far as known, was installed by G. D. Dows of Lowell in 1858, when he built a marble box equipped with one draft tube, and eight syrup cocks, which were connected with eight upright one-gallon cans. The apparatus, while crude, was a distinct novelty at that time.

In 1863 the late James W. Tufts, then operating a drug store on Hanover Street, Boston, invented and patented the apparatus known as the "Arctic," which attained such wide popularity that he abandoned the retail business and began manufacturing in one room, on Beverly Street. The enterprise grew by leaps and bounds and eventually occupied seven floors on Portland Street, while A. D. Puffer & Sons also utilized a large building nearby in producing similar apparatus. While not the pioneer, Mr. Tufts is credited with having done more to develop the industry than any other man in America.

In 1901 he was responsible for consolidating the then four principal manufacturers into the American Soda Fountain Company, which thus became the largest unit in the industry. This concern, still operating in Watertown, and the Puffer Company, with a factory in Winchester, are the pioneer concerns in New England manufacturing soda fountains.

In 1918 the United Soda Fountain Company was incorporated by a few men who were trained in soda fountain production and sales, and

who possessed vision that extended far beyond the actual production and delivery of the outfits and who realized that the customer's viewpoint was one of the vital things in business life today.

The company's factory, in Allston, was twice enlarged to meet the ever-increasing demands of the most fastidious trade in the country, including such well-known concerns as Schrafft's, Thompson's Spa, Huyler's, Bailey's Candy Stores, the Jordan Marsh Company, and St. Clair's. In New York and vicinity, the Happiness Candy Stores, Huyler's, and Schrafft's use only the United fountains—a New England product made by New England craftsmen. The Schulte-United department stores are opening all over the country and in most cases with a United fountain. The A. Schulte Cigar Stores have already started on a plan to install Huyler fountains and luncheonette units in their larger stores and in each case a United has been selected.

In May, 1929, the United Soda Fountain Company acquired by purchase the fixed assets, real estate, and good will of the American Soda Fountain Company, which retired from business after a long and busy career. By this purchase, the United Soda Fountain Company controls and operates a most efficient and desirable plant in Watertown, erected in 1927, especially for this line, and adapted to produce fountains, whose minimum sales value reaches \$2,000,000 a year.

The officers of the United enterprise are R. Lee Smith, president and general manager (formerly sales manager for the American Company); Osmon B. Gilman, a prominent retailer and manufacturer, vice president; Eugene L. Tufts, vice president in charge of sales (formerly western sales manager of the American Company), and Frank I. Hall, treasurer and clerk.

The company is the only corporation actually manufacturing soda fountains in New England from the raw material to the finished product.

THE BUCK PRINTING COMPANY

In 1852, when the Public Garden was a marsh, when most Bostonians wore Burnsides and high silk hats, A. M. Lunt established a printing business, which was the beginning of what is known today as the Buck Printing Company. Mr. Lunt operated through the exciting period of slavery agitation for six years, and was succeeded by Frederick A. Searles, in 1858, who continued the business until it became the Boston Job Print, in 1875. Fourteen years later C. H. Buck & Company, well-known sign makers of Boston, bought the company and merged it with the Spring Lane Print. The plant was moved to 88 Purchase Street, Boston, at that time and a sales office was maintained on Washington Street. From 1899 to 1907, this unit operated as a department of the sign company.

The Buck Printing Company was organized as a separate corporation in 1907, adopted for its trade-mark the appropriate emblem of the stag's head, and made a specialty of theatrical and commercial poster printing.

In 1899, Russell G. Reilly became connected with the company, and with inside experience, first in the factory and later as office manager, covering a period of fifteen years, fitted himself for the position of owner and manager. In 1914 when Mr. Buck retired the business was purchased by Mr. Reilly who during the intervening years has established

an enviable record, by building a comparatively small business into a concern that ranks as one of the largest in the East.

While the Poster Department has shown a steady growth, the greatest gain has come in the Job and Catalog Departments. During the World War the corporation was able to meet the enormous demands of the poster, job, and catalog trades, and assisted the Federal Government in an unusual manner, by handling large printing orders for the Liberty Loan Drives.

In 1927, a Silk Screen Paint Process Printing Department was established, this method consisting of producing printing of an illustrated nature without the use of metal or engraved plates. This unit has kept pace with the latest inventions and methods, and is now recognized as one of the most efficient departments in its line.

With a selling force of seven trained salesmen, and by mail solicitation throughout the United States, the products of the company are distributed from Maine to California, and from the Gulf of Mexico to Canada. A staff of capable artists is also maintained by the corporation.

A comparison of sales covering the past twelve years shows a growth of more than 600 per cent in volume. Coupled with the present management is a force of honest and capable men whose devotion and loyalty is strongly reflected in the trade's opinion of the company.

The increased business called for a larger organization, and in 1924, William F. Dugan, who had been connected with the company since 1914, was chosen vice president, while in 1928, Leonard P. Kempton, who had been with the concern since 1922, became a member of the board of directors. Russell G. Reilly has been treasurer and general manager since 1914. Charles H. W. E. Buck is president and A. G. Harrington, secretary.

The company occupies six floors of the Hecht Building, at 641 Atlantic Avenue, opposite the main entrance of the South Station, and utilizes approximately 30,000 square feet of area. The plant is equipped with a large battery of cylinder, job, and automatic presses, an engraving department with a corps of artists and engraving machines, a job department, and the largest poster equipment in the New England States.

IRON WORKS, CARPETS, AND PAINT PRODUCERS

In 1852, Thomas Cunningham founded an iron works establishment in Charlestown, which, in 1876, became known as Thos. Cunningham & Son upon the admission of John H. Cunningham to the firm, and, in 1882, upon the death of the senior member, as J. H. & T. Cunningham. In 1887 the concern was incorporated as the Cunningham Iron Company.

In 1854 Michael H. Simpson and a group of associates bought the machinery of a defunct carpet factory, in Troy, N. Y., and removed it to Roxbury, where equipment designed by Mr. Simpson was also installed, which he protected by patents and a successful carpet manufacturing business resulted from his efforts.

THE GOULD & CUTLER CORPORATION

In 1853, John A. Gould organized Gould & Co. and located at 12 Broad Street, removing to 69 Union Street in 1877. Three years before that William S. Cutler, who had been engaged in the paint business, under the name of Cutler & Stickney, since 1839, was admitted as a partner and

on December 31, 1889, the Gould & Cutler Corporation was formed—the first paint manufacturing concern in Massachusetts to secure a corporation charter. In December, 1902, the headquarters were removed to 105 North Street, corner of Cross Street, and seven years later the concern moved to 41-49 Sudbury Street, corner of Bowker Street. A. L. Cutler died December 12, 1904, John A. Gould died January 31, 1906, and William S. Cutler, son of A. L., died September 10, 1911. In January, 1929, the corporation moved to its present quarters—11-15 Stillings Street. The present officers are: president, Bertram C. Gould, son of George L. Gould, the former president; vice president, Donald G. Miller, son of Charles D. Miller, former vice president; treasurer, Guy C. Rowell; assistant treasurer and general manager, Charles W. Brown.

The Stillings Street plant represents a considerable addition over the area occupied in any of the previous locations. The concern is primarily a distributor for Benjamin Moore & Co., of New York City, which concern manufactures a complete line of paints, varnishes, enamels, wall finishes and other paint products, while the Gould & Cutler Corporation manufactures shellac, dryers, and various other products.

THE TIM-MANSON-HUCKINS COMPANY

The firm of P. S. Huckins & Co. was established September 28, 1854, by Pembroke S. Huckins, of Boston, and John Huckins, of Bangor, Maine, and occupied a wharf and yard on the water-front at Central Square, East Boston, where for seventy-five years it specialized in heavy timber and plank for shipbuilding and industrial construction.

In 1908, the concern was incorporated by Frank Huckins, son of Pembroke S. Huckins, under the firm name of P. S. Huckins Company, and twenty years later the company consolidated with the B. L. Tim-Manson Company, also of East Boston.

Recently the offices have been centralized at 422 Border Street, East Boston, and the name has been changed to Tim-Manson-Huckins Company. The present concern handles lumber and industrial woodworking of every description, continuing, however, to specialize in heavy timber and plank.

James T. Manson is president, James R. Doty, vice president, and Seigfried Hirsch, treasurer. The concern employs 125 hands.

THE S. D. WARREN COMPANY

The S. D. Warren Company, whose headquarters are located at 101 Milk Street, Boston, was formed in 1854, and has operated continuously for more than three-quarters of a century.

It owns a mill at Westbrook, Maine, which has a capacity of 240 tons of paper per day, another in Gardiner, Maine, with a capacity of fifteen tons per day, and mills for the manufacture of soda and sulphite pulp, the latter with a capacity of seventy tons per day. The company also owns or controls 200,000 acres of timber lands.

The corporation is capitalized for \$5,200,000 six per cent bonds, and 101,415 shares of no par common, and the average net profits of the company and its subsidiaries, after depreciation, federal income tax at present rate, and interest on amount of bonds now outstanding, were \$951,242 during the five years from 1924 to 1928.

THE COLEMAN & KEATING COMPANY

In 1854 the Coleman & Keating Company was established, and in 1929 it observed the seventy-fifth anniversary of its inception. Starting in a single small room, and employing but four persons, it has grown until today it occupies its own large, modern plant, at 112 Sudbury Street, in which is installed up-to-date equipment.

The original formula and blends are still in use in producing C. & K. Ginger Ale, and the present officers are: M. T. Coleman, president and treasurer, and F. A. Coleman and W. A. Coleman, vice presidents, who follow the policies laid down by the founders.

THE CUNDY-BETTONEY COMPANY

W. H. Cundy, a clarinetist, music publisher, specialist and dealer in woodwind instruments, and a native of England, came to America in 1855 and began business in Boston under his own name, dealing at that time in imported instruments, as then there were no American-made clarinets. When he retired in 1907 the Cundy-Bettoney Company was formed and Mr. Cundy disposed of his holdings to Harry Bettoney, a professional musician, who continued publishing and increased his importations of high-grade woodwinds. At that period the concern occupied a room on Hanover Street, and gradually increased the number of its employees to fifteen.

A few years before the beginning of the World War, Mr. Bettoney began the manufacture of flutes and piccolos of hard wood, hard rubber and metal, and soon found it necessary to expand his plant. In 1916 he purchased a building in Jamaica Plain and converted it into a factory.

During the war, he commenced the manufacture of wood and composition clarinets and soon increased the number of employees to 100. In 1925, he built a clarinet made of a single tube of metal and trade-marked it as the "Silva-Bet." Immediately it became a great success throughout the country, and as a result of its widespread popularity other manufacturers began producing clarinets made of various metals. In a few years, the "Silva-Bet" practically revolutionized the clarinet industry.

It was not until the spring of 1929 that a patent covering important features of the instrument was granted.

The change to the use of metal in the manufacture of clarinets brought about many improvements in the process of manufacture. Modern metal working machinery has been installed and the practice of a division of labor is in use throughout the entire Cundy-Bettoney Company factory. Two additional buildings have been acquired during the past five years and the number of employees has been increased to between one hundred and fifty and two hundred, 50 per cent of whom are women. Since 1925 several other lines of instruments have been added to the company's catalogue, and at present the concern is one of the foremost woodwind manufacturers of the world. Its products are not only marketed throughout the United States, but are exported to Europe and Australasia. Harry Bettoney is manager and owner of the business.

E. FLEMING & COMPANY

In 1855, Edward Fleming, a native of England, formed a partnership with Alfred Haskel, under the name of E. Fleming & Co., which continued for thirteen years.

In 1856 the firm established a modest book bindery, on Sudbury Street, Boston, which was operated until 1875, when it was completely destroyed by fire. The business was at once reestablished at 46 Franklin Street, and Orman Bazin was admitted as a partner, while Charles Laurie entered the firm in 1882. The following year Mr. Bazin died, and in 1887 the partners removed to 208 Summer Street, six years later the founder died, and his interest passed to two grandsons—Charles B. and Samuel N. Fleming. In 1901, Charles T. Baker, who had been connected with the concern since 1883, became a partner, and upon the death of Mr. Laurie, later in the same year, Mr. Baker became the managing head. There has been no change in the organization since that time, the Messrs. Baker and Charles B. and Samuel N. Fleming constituting the partnership today.

In 1897 the firm established a bindery at the Norwood Press, in Norwood, where upwards of fifty per cent of the business is done.

In 1902 fire totally destroyed the Summer Street bindery, but the business was reestablished at that location, with complete new equipment.

In 1918 a steel and concrete daylight bindery was erected on Main Street, Cambridge, and here school books, novels, and catalogs were bound, but the main product is the binding of sets of books. The many editions of the constantly advertised "Book of Knowledge" were bound at this plant. It consists of twenty volumes, is printed in several languages and is bound in many handsome styles. The Cambridge factory bound hundreds of thousands of these sets, and in busy seasons turned out as many as 10,000 sets in a month, or a total of nearly 8,000 volumes a day, not including other binding contracts that were executed simultaneously.

The Fleming bindery, at 470 Atlantic Avenue, is equipped with the latest machinery and in binding a book all the sheets delivered by the printer are machine counted on a weighing machine immediately upon being received, so that the work may begin with an absolutely correct count. They are then placed upon movable platforms where they can be taken to the folding machines without additional handling. From here the sheets go to the gathering machine which takes the various sections and gathers them into a book. This machine is almost human in its operation. Each section of the book is put in its proper sequence in a separate pocket of the machine. If the machine misses a section, as it occasionally does, or if it should take up two copies of a section, it automatically stops and the operator rectifies the mistake.

Although this machine is supposed to be perfect in performing its work, it is the practice of the company to guard against any possibility of error by a personal examination of each book before it is sewed. Thus the mistakes of misplaced pages and missing pages, the greatest source of trouble both to the bookbinder and to the public, are eliminated by the particular care taken in this operation.

E. Fleming & Co. employs upwards of four hundred operatives.

THE GROVER & BAKER SEWING MACHINE COMPANY

The Grover & Baker Sewing Machine Company erected a factory on Washington Street, Boston, in 1856, for the manufacture of about twenty different styles of sewing machines, making both the Grover & Baker

and the Shuttle (Howe) stitch. The products were used in sewing lace, linen, canvas, bagging, cloth, and leather.

The Grover & Baker patents granted in 1851 and 1852 dispensed with the use of a shuttle, and were capable of producing a double loop, with two threads. The machines carried two needles, only one of which entered the cloth, but both were fed from stationary spools, the threads of which were tied at every stitch, double-fastening every loop. Consequently each stitch was independent of every other, and though every third stitch was cut by the operator of the machine, the seams would not rip or ravel.

Thousands of the machines were used in the millinery and upholstery business, in the factories of harness-makers, in the plants of boot and shoe manufacturers, carriage trimmers, bag makers and on the cotton plantations of the South, while in England and Scotland they added to the prestige of New England ingenuity.

THE GEORGE STECK PIANO COMPANY

George Steck was one of the few great piano builders of history, being not only an artist in the true sense, but a master craftsman. He possessed not only tonal ideas, but the genius to give them expression and was recognized among his contemporaries as one of the foremost authorities on piano tone and construction.

He founded George Steck & Company in 1857 and from his great work as an artist, tone expert and craftsman, came the George Steck piano, which grew to international fame under his direction and leadership.

As far back as 1873 it received first prize at the Vienna Exposition, at which honors were not shared as but one first prize was awarded, thus indicating absolute supremacy among the leading European and American instruments. Again, when the Grand Nibelungen Orchestra, at Bayreuth, desired to tender Richard Wagner a special token of their affection, it was a George Steck piano that was chosen as the gift. The written expression of Wagner's enthusiasm for the instrument, as well as that of his great friend, Franz Liszt, who played it at his home, indicates how fully realized was George Steck's ambition for his instrument.

In December, 1904, the business and factories of the George Steck Piano Company were consolidated with The Aeolian Company, and became a part of the foremost musical instrument business of the world.

The George Steck piano is manufactured in five countries—America, England, France, Germany and Australia—and is one of the three great international instruments.

The George Steck & Company factory at Neponset is one of the most modern piano plants in the United States. Its spacious workrooms, modern machinery, expert and skilled workmen, together with ideal manufacturing conditions, make possible the continuation of the quality and tone of the George Steck piano handed down to The Aeolian Company by the genius and inventor.

The Aeolian Company has recently spent several hundred thousand dollars enlarging the building and improving the plant in general. The main structure is now six hundred fifty feet long, eighty-eight feet wide and five stories high. The storage yard has a capacity of a million and

one-half feet of lumber and three-quarters of a million feet of veneer. In addition are the dry kilns and administrative offices.

The plant is equipped with the most modern type of machinery, all of which is directly connected with electric motors. There is nearly a mile of track in the yard and all switching is done by the company's gasoline locomotive. A large dock, located on the Neponset River, connects the plant directly with Boston Harbor. The company has its own restaurant for employees and a hospital with nurses in attendance.

It recently acquired twenty additional acres of land, adjoining the site of the factories at Neponset, which location offers unusual facilities for plant maintenance that have contributed largely to the convenience of the operation of this enormous piano enterprise, which enjoys exclusive switching and carloading facilities at its very doors.

The corporation employs 400 operatives at its plant in Neponset.

BOSTON'S PRIMACY IN THE COPPER INDUSTRY

No insignificant part of the wealth which Boston poured into the transcontinental railroads during the nineteenth century and into the development of many industrial and commercial enterprises of the West was derived from the profits accruing from the almost interminable number of copper mines that Boston has cradled during the past 100 years.

The story of the inter-relation of the Boston stock markets and the development of the greatest copper mines in the United States is not only a long but a fascinating and romantic chapter in the rise of this nation to unquestioned supremacy in the world production of the red metal.

And here again had it not been for the support given to pioneer mining enterprises by the Boston Stock Exchange and the Boston Curb Market it is extremely doubtful whether the production of copper in America would be as extensive as it is today, in that there would not have been so many individual fortunes accumulated by the purchasers of securities at prospect prices of undeveloped mining properties, which later became great producers and which afterward sold at tens of thousands of per cent profit over the figures at which they were originally purchased.

The linking of Boston and copper goes back to the period between 1830 and 1850 when her citizens became the financial nursery of the Michigan copper mines, the first of Boston's big successes, although by no means the greatest, being the Quincy Mine, which began in 1856 as the Central at \$2.50 a share, reaching \$41 in 1859, \$112 in 1864, and the high mark of \$760 a share in 1899, in which year the market price of the stock was \$190 per share, but of which issue four shares were equivalent to the original stock acquired by Boston investors, at \$2.50 per share. This company has a record of dividend continuity represented by payments to its shareholders of more than \$27,000,000, and the Quincy Mine formed the foundation of the Phelps-Dodge fortune, which was destined to expand in the Bisbee district of Arizona.

The greatest of the triumphs in the Boston stock market, however, and the one that laid the foundation of the immense fortunes of the first families of the Hub, and the product of which was translated into brick and brownstone on Commonwealth Avenue and Beacon Street, and was poured into art, literature and education is the outstanding copper mine of all history—the famous Calumet & Hecla, which originally was no

more than a pure, unadulterated mining speculation, and whose stock between 1865 and 1866 was kicked around the Boston market under \$1 a share. In 1907 it sold for \$1,000 a share, and it has paid between its inception and today upwards of \$175,000,000 in dividends.

Analysis of the copper situation reveals the fact that while the New York Stock Market has claimed sponsorship for many of the successful copper mines and copper speculations of recent years, the claims of the American Metropolis are unsupported and not only did Boston interests play the principal role in their development, but her shareholders reaped a magnificent financial harvest from these properties which now constitute the very backbone of the mining industry of America. Most of them have grown from what would today be characterized as wild-cat speculations. Boston investors largely financed Boston & Montana, the Consolidated Gold & Silver Mining Company, and the Butte & Boston Consolidated Mining Company. The Consolidated and Butte & Boston enterprises eventually became a part of the merger when the Amalgamated Copper Company was formed.

Bostonians who bought the original Boston & Montana stock for \$15 a share saw it rise to \$498, while those who purchased Butte & Boston at \$1 a share observed its advance to \$124.

Butte & Superior was financed by a Boston investment house, and the stock soared from \$5 a share to \$105.25. The same financial firm promoted and sponsored Utah Copper, Nevada Consolidated, Ray Consolidated and Chino, which mines have paid more than \$250,000,000 in dividends to their stockholders. It was Boston capital that developed Greene-Cananea, Calumet & Arizona and North Butte, and that was responsible for the formation of the United States Smelting, Refining & Mining Company, the Bingham Mines, Utah Consolidated and Utah Apex, which are favorites in Boston and which have made millions for their original stockholders.

Of the more recent successes, Ahumada Lead sold on the Boston Curb at 50 cents a share in 1919. Those who bought the stock at that time have seen their purchases grow twenty-five times in market value, and today the stock is listed on the New York Stock Exchange.

One of the old standbys of the Boston Curb Market is United Verde Extension, the shares of which advanced from 28 cents in 1913 on the Boston Curb to \$52 a share in 1919 in the same market, and which has paid more than \$24,000,000 in dividends.

The list might well be lengthened were the full story of Boston's investments in copper to be written.

Boston has always been and probably always will be the prime market for the securities of young copper mines. From time to time other markets have overshadowed it but Boston goes on contributing its share to the development of new metal mines all over the United States as it has done for a century. The history of Boston and metals, especially copper, is one of the greatest romances of American industrial progress and one in which the final chapter is by no means written.

A few of the outstanding Boston successes in metal stocks, are here recorded, with a table showing their early low prices, the figures at which they subsequently sold, and the percentage of profits that accrued to the stockholders who held their shares:

	Early "Low"	Rose to	Per Cent Profit
Ahumada Lead -----	\$1	\$125 $\frac{5}{8}$	1,162
Allouez -----	9c	74 $\frac{1}{4}$	82,400
Atlantic, Mich. -----	6c	45	74,900
Am. Zinc-Lead -----	\$6	53	783
Bingham Mines -----	\$3	60 $\frac{1}{2}$	1,917
Boston-Mont. -----	\$15	498	3,220
Butte & Boston -----	\$1	124 $\frac{1}{2}$	12,350
Butte & Superior -----	\$5	105 $\frac{1}{4}$	2,000
Calumet-Ariz. -----	\$8	198	2,375
Calumet & Hecla -----	\$1	\$1,000	99,900
Chino -----	\$5	76	1,420
Eagle-Blue Bell -----	50c	4	700
First Nat. Cop. -----	50c	8	1,500
Isle Royale -----	\$5 $\frac{1}{4}$	35 $\frac{1}{4}$	571
McK-Darragh -----	40c	41 $\frac{1}{4}$	962
Mass., Mich. -----	\$2 $\frac{3}{8}$	18 $\frac{1}{4}$	670
Miami Copper -----	\$4 $\frac{5}{8}$	49 $\frac{1}{4}$	970
North Butte -----	\$14	113	707
Old Dominion -----	50c	66 $\frac{3}{4}$	13,250
Osceola -----	\$18	181	905
Quincy -----	\$5	760	15,100
Shannon -----	\$3 $\frac{1}{2}$	24 $\frac{3}{8}$	568
Tamarack -----	\$15	220	1,367
Trinity -----	\$4 $\frac{1}{4}$	46 $\frac{1}{2}$	994
Un. Verde Ex. -----	28c	52	18,471
Wolverine -----	\$11 $\frac{1}{2}$	198	13,100

In 1929 an attempt was made to transfer the headquarters of the Calumet & Hecla Consolidated Copper Company from Beacon Hill, Boston, to New York City, and a battle of proxies was staged for a full month in advance of a special meeting of the stockholders, on May 23 of that year, but it was decided that after fifty-eight years of corporate domicile in the Hub, the legal residence should not be transferred. From the standpoint of the board of directors it is of public interest to note that nine of the thirteen are Boston men, with two resident in Michigan, the twelfth a resident of another New England state, and the thirteenth a New Yorker.

The story of Calumet & Hecla is one of the thrilling and romantic chapters in the history of America's copper industry, and typifies the faith of two men of vision and of their indomitable pluck, the one located in Boston facing bankruptcy for weeks upon weeks, but courageously seeking additional capital each day, with the other in the bleak peninsula of Northern Michigan, meeting armed foes, disasters to the primitive mining machinery originally installed, as well as the treachery of several men who should have been his backers and helpers. Had it not been for the tenacity of Quincy A. Shaw, Sr., and Alexander Agassiz the nation's greatest mining properties would not have come into existence under the auspices of Boston capital.

Sixty-six years ago Edwin Hurlburt, a road surveyor, engaged in laying out a highway in Michigan, stumbled upon what he thought at first

was an old Indian cache, but which after blasting a bit proved to be a mine, that later came to be known to the world as the Calumet, and from which, with its neighbor, the Hecla unit, there have been taken more than four billion pounds of copper. Convinced of the value of the strike, Hurlburt came to Boston, then as now the seat of the Lake Superior interests, interviewed Shaw, who in turn repeated the glowing reports of prospect to his friends, among them Alexander Agassiz, son of the famous American scientist, Professor Louis Agassiz. The latter was away at the time, and after a controlling interest had been purchased and future options had been secured in the property by Messrs. Shaw, Agassiz, and their friends, the son went to Michigan, ostensibly to seek a much needed rest. Almost overnight, Alexander Agassiz became so favorably impressed with the prospect that the son of the great naturalist and biologist became a miner, and he persuaded Shaw and the Boston group to buy the Hecla region, in which Agassiz invested heavily. A year passed, and the future did not look bright. There was so much copper about that Hurlburt was dazzled by the outlook. He bought a hundred pairs of horses to haul the ore thirteen miles to the shipping point, at Hancock, quarried haphazardly and wastefully, and it soon appeared that the strike could not be made to pay by these methods.

The Hurlburt lease was terminated and Agassiz hired an experienced mine operator, and perhaps peered into that future day when the stock of the company was to be worth upwards of \$60,000,000 and when the earnings in the form of dividends paid since 1869 would aggregate at least \$175,000,000.

But the full story of Calumet & Hecla was that of surmounting almost insuperable difficulties against the greatest odds.

The hard, heavy and tenacious conglomerate of Calumet and Hecla was a very different thing to mine and mill from the comparatively soft and less finely subdivided amygdaloid hitherto harvested in Northern Michigan, and the best mining men of the day declared it could not be accomplished at a profit.

The true condition of affairs as they actually stood at Calumet was not correctly represented by Hurlburt and the venture threatened to end disastrously for all concerned.

Letters came fast from Agassiz at the mine, and behind their technicalities lay a story of a fight against odds. Nothing seemed to go right; the rollers of the mills would not work; the expenses piled up and the profits dwindled. Shaw in Boston was being worried sick.

The two finally decided that to make the mill pay, money must be spent. Rollers were abandoned and more efficient stamps were placed in the mills. The railroad was pushed to completion. A mill was built at Hecla. John Simpkins of New York, heavily interested in the mines, furnished additional money.

Accidents happened. Agassiz and his wife spent the cold and bitter winter on the scene, living in the crudest of homes. The walls gave in; the mines sank; snow and cold delayed the work.

Edwin Hurlburt and his brother, John, instituted law suits; the miners turned against Agassiz and there were fights among the men. John Hurlburt fled the scene, leaving behind him an agent, and then a dam was cut and the mill flooded. Next the Hurlburts sought injunction proceedings.

Fortunately the damage was temporarily repaired before an injunc-

tion could be served; the supply of water proved greater than was expected and soon there was sufficient to run the mill regularly.

In August, 1865, Hecla produced about one hundred and eighty-five tons of ingot and Calumet about one hundred and forty tons, each mill stamping over four thousand tons of rock during the month. Late in September the long strain was over and the fight successful, but at the cost, as it afterwards proved, of the loss of the health of Alexander Agassiz.

Late in 1868, he returned to the more congenial labors of the scholar, at Cambridge, but always afterwards he paid a visit to the mines in the spring and another in the fall, except on the rare occasions when he was prevented by illness or absence from the country. His travels and scientific expeditions were usually so timed as not to interfere with these semi-annual visits, and more than one voyage of exploration was postponed or abandoned owing to an unsatisfactory condition at the mine that required his personal attention.

The Hecla mine, being less far advanced, was not in so bad a condition as Calumet, but the openings appeared to have been wrongly made as had those at Calumet.

While Agassiz on his part was endeavoring, with insufficient means, to start everything afresh, surrounded by incompetent and dishonest superintendents who had been running the affairs of the mine to their own advantage, Shaw in Boston was confronted with equal, if not more trying difficulties.

The mines had already consumed more money than had been expected, and Shaw's affairs were involved. He was at the end of his financial resources, pressed by his creditors, and loaded with law suits. In the face of all this, he was straining every nerve to get money to develop the properties from a community that had lost confidence in them.

On December 15, 1869, Hecla paid its first dividend, and in May, 1871, the Hecla and Calumet mines and the Portland and the Scott mining companies were consolidated into the Calumet and Hecla Mining Company, with capital stock of 80,000 shares, Mr. Shaw serving as its first president. A few months later he retired to the board of directors, and Agassiz was made president, a position which he held to the end of his life.

Until a few years before Mr. Shaw's death in 1908, he and Agassiz directed the policy of the company, but as the former had no training as an engineer, the work of developing the mine itself fell to Agassiz. It was always his policy to keep the mine opened up well ahead of the work—fifteen or twenty years ahead in later years—and when it became certain that the lode contained a vast amount of profitable rock, he had the ability to see what the conditions would be years later, and make ready for them in advance.

Such a policy naturally incurred great expense, for, to use his own words, he always spent a dollar and a half if he could see three dollars in the future.

Some of the stockholders were not far-sighted enough to perceive the wisdom of this course, and there was no little criticism of the extravagant management of the mine, much of which came from the very men who had formerly declared that the lode could not be mined at a profit. For example, the installation, in 1883, of the 5,000 horsepower "Superior" engine, a huge machine for those days, was thought by some to be a foolish proceeding. It was designed to hoist six skips, each with a

capacity of four tons of rock, from a depth of 4,000 feet and also to run four Rand compressors. This was greatly in excess of the needs of the mine then, which was hoisting two-and-a-half-ton skips from an average depth of about fifteen hundred feet, but in 1911, this engine was hoisting seven-and-a-half-ton skips from a depth of 6,000 feet. On one occasion Agassiz threw away, unused, without the slightest hesitation, some extremely expensive machinery, because while it was being made he had discovered a cheaper method and realized that this action would prove far wiser in the end.

In 1901, James MacNaughton, a product of the younger generation which has grown up at Calumet, was made general manager. A new generation also was growing up in the Boston office, where another Quincy A. Shaw and Agassiz's youngest son, Rodolphe, were working into the management and relieving the president of many details.

The company grew and finally became the Hecla and Calumet Consolidated Copper Company. Five serious fires, the last in 1900, in which many lives were lost and much damage was done, did not deter its phenomenal progress.

During the copper boom of 1906 the company's stock seldom went below \$900 per share. Other copper concerns were bought and amalgamated with the original company, and the dividends received have been invested in many Boston enterprises. Today the stock is high, the present average quotation, owing to stock splits and amalgamations being worth the \$1,000 that was paid for one share years ago.

C. W. WHITE & COMPANY, INC.

In 1857, Dr. Charles W. White founded the firm of C. W. White & Co., which confined its activities at the outset to the wholesaling of trusses, occupying a single room at 99 Court Street, Boston.

The necessary parts were secured from various concerns, made to the order of the firm, and assembled and distributed by the company.

As time went on more area was required and when forced out of its original quarters in 1924 by the street widening policy of the city of Boston the company occupied about 12,000 square feet of the building at 99 Court Street, with the exception of the ground floor.

At that period the concern was manufacturing all parts of trusses and had added druggists', physicians', and hospital sundries, including all kinds of abdominal supporters, surgical elastic hosiery, suspensories, orthopedic appliances, arch supporters, crutches, canes, elastic bandages, rubber goods and special corseting.

One of its early undertakings, which was perhaps more largely responsible for its growth than any other one item, was the importation of looms and operators for the manufacture of surgical elastic hosiery, in which field it was a pioneer. It has become one of the largest manufacturers of hand knit elastic hosiery in the country.

In 1924 the concern equipped a factory, fitting rooms, office, stock and shipping rooms at 81 Washington Street, and occupies approximately 14,000 square feet.

Early in its history the local demand for its goods was such that it found it necessary to maintain expert men and women fitters for the purpose of catering to individuals who desired the benefit of the company's experience.

While there have been four sets of owners since its beginning, there

has always been at least one individual whose interest, by relationship or otherwise, dated back to the founder.

The company was incorporated in 1917 and employs approximately one hundred men and women.

The present officers are: V. A. Longaker, president and treasurer; J. S. Hunter, vice president, and B. L. Longaker, secretary, who constitute the board of directors.

The company's travelling representatives cover the entire country.

THE DAVIDSON RUBBER COMPANY

Since 1857, when the late Doctor Davidson began the manufacture of druggists' rubber sundries, at 50 Brighton Street, Charlestown, production has been continuously carried on at that location during the intervening nearly seventy-three years.

In 1904 the business was incorporated as the Davidson Rubber Company, with capital of \$200,000, and in 1929 upon the death of late Alexander M. Paul, who was president of the concern, the corporation was re-organized. L. P. Paul is vice president and treasurer and C. L. Newton is assistant treasurer, and 100 hands are employed.

THE AMERICAN SUGAR REFINERY COMPANY

Seth Adams, founder of the Adams Sugar Refinery, now the Revere Sugar Refinery, owned and operated by the United Fruit Company, proved himself not only one of Boston's most enterprising and successful business men, but as resourceful as any citizen of his day, when he re-



SETH ADAMS
of Boston

Who conceived the Adams
Sugar Refinery of Boston,
in 1858

claimed from the Atlantic upwards of 90,000 square feet of land where formerly the tide ebbed and flowed, and erected thereon his original sugar refinery.

In the summer of 1858 work on a sea wall was begun, some 12,000 piles being driven, while 5,000 squares of gravel were deposited, over which a heavy granite foundation was laid. On this a brick superstructure was erected, with the walls at the base three feet thick, and extending ninety feet in the air, requiring 5,500,000 brick, 40 cargoes of sand, 4,500 casks of lime, and 1,500 casks of cement. The main building was 118 by 80 feet, nine stories in height, and each floor being supported by 162 large iron columns. A storehouse 200 by 500 feet; another, five stories high, for refined sugar; a charcoal house, 130 by 48 feet, with a chimney

120 feet high; a detached boiler house, 64 by 54 feet, with another 120-foot chimney, and several smaller structures constituted the original plant.

Seth Adams was identified with the invention and manufacture of the Adams printing press, which his brother, Isaac, had designed, in 1833, and in after years Seth was granted four patents for improvements in printing presses, ship windlasses and steam valves. In 1836, when his brother invented the famous Adams power-press, he joined with him in the firm of I. & S. Adams, erected a machine shop and manufactured presses.

In 1849, due to the failure of a firm of sugar refiners that was heavily indebted to him for machinery and cash advances, Seth Adams was forced to purchase the assets to secure himself from loss, and when, in 1858, the old refinery was destroyed by fire, he began the erection of the new plant.

He was one of the most remarkable and self-made Massachusetts men of the last century, and the ramifications of his industrial activities were many and varied.

It is an interesting commentary that in the data applying to the principal manufacturing industries of the Metropolitan district the value of the manufactured products of sugar refining ranks second and is exceeded in total only by those of boots and shoes, but as this industry has as its component parts only two Boston units—the Revere and American Sugar Refineries—the actual value of the yearly products cannot be shown in dollars and cents without disclosing the operations of each.

It is all the more interesting perhaps to consider the importance of the trade in the industrial life of Metropolitan Boston when one realizes that the raw materials which go into this all-important business are transported by water hundreds of miles from where they are produced in Cuba to the Hub in order to be made into an article of every-day necessity and convenience.

The main building, erected by Seth Adams, in 1858-9 is still in active use by the American Sugar Refining Company, which operates the old Adams plant. At the time the refinery was acquired by interests outside of the Adams family, the face of the brownstone slab, bearing the inscription, "Seth Adams 1859" was chiseled off, but under certain atmospheric conditions it can still be faintly deciphered.

The Boston headquarters of the American Sugar Refining Company are at 20 Broad Street, and the factory is located at 47 Granite Street. W. Edward Foster is president, Harry E. Edgecomb, secretary, and A. B. Wollam, treasurer.

THE ATLANTIC MONTHLY COMPANY

Of the eminent founders who accepted the invitation of the first publisher, Moses Dresser Phillips, of the Boston firm of Phillips, Sampson & Co., to a dinner held at the Old Parker House, on May 5, 1857, to consider the wisdom of creating a new literary and political magazine, Ralph Waldo Emerson, was fifty-four years of age; Henry Wadsworth Longfellow, was then fifty; Oliver Wendell Holmes, was forty-eight; John Lothrop Motley, was forty-three; James Russell Lowell, its first editor, was thirty-eight; James Elliot Cabot, who years later became the biographer of Emerson, was thirty-six; and Francis H. Underwood, the "literary man," of the Phillips firm, and the prime mover in the undertaking, was but thirty-two. The ages of these writers who gave the *Atlantic* its original high position in American literature betoken the fact that the magazine was never entirely a youthful experiment, and

demonstrate that it was planned and placed firmly on its feet by a remarkable group of men who were then in or very near the prime of their great powers.

Now an octogenarian in age, the *Atlantic Monthly* has achieved, by universal consent, a permanent place in the literature of the world.

What a wealth of enduring titles it has carried in its long life! It was between its covers that Holmes gave to the world "The Chambered Nautilus" and "The Wonderful One Hoss Shay," as well as "The Autocrat of The Breakfast Table." It was in the February, 1862, number that Julia Ward Howe's immortal "Battle Hymn of The Republic," first appeared in type. It was in the November, 1863, issue that Edward Everett Hale's classic, "The Man Without A Country," was printed.

James Russell Lowell's celebrated Biglow Papers ran from January to June, 1862, and again the next year, and in 1865 and 1866, while his "Commemoration Ode" was first printed in the September, 1865, number.

The October, 1863, number first carried John Greenleaf Whittier's "Barbara Frietchie," which aroused a greater thrill of patriotism than any other poetic literature of the Civil War period.

Ralph Waldo Emerson's "Days" was printed in the first issue of the *Atlantic*, and Browning's "Prospice" appeared in the May, 1864, number. Henry Wadsworth Longfellow provided "The Children's Hour" in the September, 1860, issue, and "The Ride of Paul Revere," in the January, 1861, number.

In the January, 1873, issue, Thomas Bailey Aldrich's "Marjorie Daw" first appeared in American literature, having been preceded by Bret Harte's "How Santa Claus Came to Simpson's Bar," which was printed in the March, 1872, number.

The issues from January to June, as well as that of August, 1875, were enlivened by Samuel L. Clemens' "Old Times On The Mississippi."

William Dean Howells' "The Lady of The Aroostook" ran from November, 1878, to March, 1879, and Sills' "A Fool's Prayer," appeared in the April, 1879, issue.

From April to June, 1883, Henry James, Jr., contributed his "Daisy Miller," and in the September, 1884 number, Parkman, the great historian, presented "Wolfe on the Plains of Abraham."

Rudyard Kipling's "The Disturber of Traffic," appeared in the September, 1891, issue, and four numbers in 1896 presented Miss Jewett's, "The Country of the Painted Furs." From February to May, 1899, appeared James' "Talks to Teachers on Psychology," and in the April, 1900, issue Moody's "Ode in Time of Hesitation" was first printed.

One might go on and cite hundreds of other notable contributions to the *Atlantic* by the most famous authors, essayists and publicists of the last seventy years. The magazine has indeed been fortunate in its editorship. In its seventy-two years of existence it has had but eight editors. From 1857 to 1861 James Russell Lowell served in this position, and from 1861 to 1871 James Thomas Fields was at the head of the editorial department. He was followed by William Dean Howells, who served from 1871 to 1881, and he by Thomas Bailey Aldrich, who edited the magazine from 1881 to 1890. Then came Horace Elisha Scudder from 1890 to 1898, and Walter Hines Page, from 1898 to 1899. Bliss Perry was its editor from 1899 to 1909, and from the latter year forward Ellery Sedgwick has been its presiding genius.

The original publishing house of Phillips, Sampson & Co., sold the

magazine to Ticknor & Fields, in 1859, and in 1867 Fields, Osgood & Co., became the publisher. In 1871 James R. Osgood & Co., acquired the management, and in 1874 H. O. Houghton & Co., became the owners. Four years later, Houghton, Osgood & Co., bought the business, and from 1880 to 1908, the *Atlantic* was published by Houghton, Mifflin & Co.

The latter year, the Atlantic Monthly Company was incorporated and has owned the magazine since. Under this management, the *House Beautiful*, and the *Living Age*, the latter established in 1844, were acquired.

The Boston office of The Atlantic Monthly Company is at 8 Arlington Street, and branches are maintained in New York and Chicago.

Ellery Sedgwick is president and treasurer, Mark A. DeWolfe Howe, vice president, and Nelson J. Peabody, publisher, and the concern employs 250 operatives.

EDWARD F. KAKAS & SONS, INC.

Edward F. Kakas & Sons, Inc., was established on Winter Street, in 1858, by Edward Kakas and when it outgrew the premises a removal was made to Summer Street, where the business was burned out by the great Boston fire of 1872. Mr. Kakas next moved to 404 Washington Street, taking his sons, William F. and Edward F. into the business under the name of Edward Kakas & Sons. Noting the trend of specialty stores moving further uptown the business was transferred to 162 Tremont Street. In 1897 William F. Kakas left the firm and in 1905 Edward Kakas died, at which time the business was taken over by his eldest son, Edward F., under the name of Edward F. Kakas & Sons. The trend of specialty stores still continued further uptown, and in 1910 the firm moved to 364 Boylston Street and ten years later the firm was incorporated as Edward F. Kakas & Sons, Inc., Edward F. Kakas taking his two sons, Fred G. and Harry B., into the corporation with him.

In 1925 the concern moved to its present location at 93-95 Newbury Street, owned and built by it and adapted entirely to the needs of the business. In March, 1926, Edward F. Kakas, the president of the corporation, died and one son, Fred G., became president, and the other, Harry B., was chosen treasurer.

Their sons, Edward G. and George J. Kakas, being associated with them, brings the third and fourth generations into the business. About ninety-five per cent of the furs used by the company are manufactured on the premises. The concern deals largely in raw furs, carries a large stock of dressed furs, and does a large dry cold storage and repair business. The increase in gross sales in less than ten years has been more than 100%. The concern employs an average of sixty people the year round, and there are nine employees who have been with the enterprise from thirty to forty-five years. The company is one of the oldest and largest strictly retail fur stores in the country.

THE HERSEY MANUFACTURING COMPANY

In December, 1859, Walter E. Hawes and Charles H. Hersey formed a partnership, under the name of Hawes and Hersey, and established a machine shop at the corner of E. and Second streets, South Boston. In November, 1865, C. Hersey, brother of Charles entered the firm and seven years afterward, the Messrs. Hersey purchased the interest held by Mr. Hawes and continued the business under the name of Hersey Brothers

and devoted production to the manufacture of special patented machinery for the sugar and soap industries.

The development by them of a machine for finishing the soft sugars, then in general use, and which were more or less subject to deterioration, gave to the world the sparkling granulated form of sugar which is in such universal use today and of which practically every pound produced passes through the "Hersey Granulator." They also invented and developed a machine for manufacturing the familiar "Cube" sugar, which has largely taken the place of the older forms of hard sugar known as cone, lump, broken and cut sugar. These machines are in all refineries throughout the United States and used in all parts of the world where refined sugars are produced.

The partners also patented and built many other machines which were used in the soap, salt and malt industries.

In 1880, James A. Tilden, who had become associated with the Messrs. Hersey applied his energies to the development of a water meter and five years later Henry D. Winton became a member of the firm and assisted in this development. Under the patents granted to Mr. Tilden this part of the production became very important. In 1885, the Hersey Meter Company was incorporated, and the business developed so advantageously that five years later the new company purchased the entire assets from the Messrs. Hersey and the concern was reorganized under the name of the Hersey Manufacturing Company.

From a comparatively small beginning, occupying at the outset a building containing approximately 5,000 square feet, of two story wooden construction, the concern has grown until today it utilizes a group of brick and reinforced concrete structures affording floor space of 66,000 square feet, equipped with the latest and most up-to-date machinery, largely of special character, for the economical handling of the company's products.

The sugar department under the direction of J. Franklin Charnock is still turning out special machinery, which finds its way into all countries where sugar is made.

The meter department has grown to large proportions and in addition to the manufacture of domestic house meters, which are turned out in large quantities and of which there were comparatively few used when the business started, there are produced varied types of meters to meet demands that did not exist in the early history of the business. One of these, which has had a large market, is a fire service meter in the development of which this company was the pioneer, under the patents of J. A. Tilden. It is especially adapted to the measurement of water in manufacturing plants where there are fire or sprinkler services and is capable of measuring all rates of flow without jeopardizing the fire service through loss of head in the fire line in case of a blaze on the premises. Other products of the company include devices for measuring water under varying conditions, known as proportional, compound and current meters, and others for measuring hot water, oils and gasoline, the general use of which demand meters specially adapted for the purpose.

Although competition has kept pace with the growth of water meterage, the Hersey Manufacturing Company stands in the forefront as manufacturers of water meters of the highest grade of workmanship and materials, and with the widest range of apparatus to cover every class

of service to be found in water works practice. It employs 400 or more hands.

Since the death of the founders the company has maintained the same type of organization and the same business policies, with Walter A. Hersey, president and Francis C. Hersey, treasurer; and they, with Messrs. A. C. Harvey, H. L. Felton, B. Jenney, E. H. Baker, and W. Edmunds, form the executive management.

The corporation has capital of \$1,200,000 and is one of the Hub's noted industries.

HOLMAN & COMPANY, INC.

As early as January 1, 1859, John Holman issued a circular directing the attention of the trade to enlarged facilities for manufacturing bedding and bedding supplies, at 60 Union Street, Boston. Later the business was removed to 41 Washington Street, and in 1880 the founder's two sons, John C. and Walter A. Holman were admitted to the firm. On July 1, 1882 the concern moved to 188 Hanover Street, and two years later John C. Holman retired and Eugene D. Lacount was admitted to the firm. John Holman, the founder, died the next year, and his son and Mr. Lacount continued the business under the name of John Holman & Co., removing to the present location at 134 Richmond Street, on January 1, 1895.

The concern was incorporated January 1, 1920, as Holman & Co., Inc., with capital of \$40,000 and with Walter A. Holman, president, Eugene D. Lacount, treasurer, and Fred H. Williams, clerk.

The principal products of the earlier years, were curled hair, husk, cotton and excelsior mattresses, and feathers prepared for beds and pillows. Gradually excelsior and husk were discarded and Kapok, or silk floss, and felted cotton in lieu of loose cotton were used, with curled hair. Still more recently the company has manufactured its mattresses with light, soft springs inserted in the center, and about forty years ago the concern began the production of upholstered spring beds, with hair or cotton tops.

The company utilizes about 20,000 square feet of floor space, and employs thirty operatives. Thomas H. Kane is president, Fred H. Williams, secretary, Eugene D. Lacount, treasurer, and R. K. Miller, Jr., general manager.

THE EDSON MANUFACTURING CORPORATION

In 1859 Henry N. Stone established the business which has been in continuous operation for more than seventy years, and which has been known for a long period of time as the Edson Manufacturing Corporation.

In Mr. Stone's employ was Jacob Edson, to whom were ultimately granted 125 patents, and who became a partner in the enterprise, and upon the retirement of the founder, in 1884, the head of the Edson Manufacturing Company which was incorporated that year.

Ten years later when Mr. Edson died the controlling interest in the concern was disposed of by his heirs to George D. Loud, and others, and in 1920, when Mr. Loud retired, the present management purchased the majority holdings, and on January 1, 1921, reincorporated as the Edson Manufacturing Corporation.

One of Jacob Edson's principal patents covered the development of the Edson diaphragm pump, which soon became known all over the world

as the best non-chokable bilge pump used on vessels, and for pumping vats, trenches, cesspools, and the like. Originally designed as a hand-operated pump, it was soon adapted to power operation by gasoline engine or electric motor, and while the Edson Corporation has made improvements in the various types of units manufactured, nobody has been able to improve upon the basic principles of the original Edson diaphragm type. As first developed, the vacuum was created by means of canvas, treated with oil or other preparations, which soon deteriorated under water. To obviate that difficulty, Jacob Edson perfected a diaphragm of rubber and fabric, which he patented in 1850, since which time it has served as the world-wide standard.

De Witt King, one of the original employees of the concern, who did much of the mechanical work on Edson's first pump, retired but a few years ago and now resides with his son, in Chicago, while several others who have been employed in the company's plant for upwards of fifty years, are still on the payrolls.

From 1859 to 1902, the factory was located at 132 Commercial Street, but in the latter year it was removed to 255 Atlantic Avenue, where it remained until 1921, when a new location was occupied at 375 Broadway. In June, 1929, the corporation removed to its new daylight building, at 49-51 D Street, South Boston.

In the earlier days, many units and fittings required by vessels were manufactured, but in the march of the years some of these patented items became obsolete, and today the Edson products have substantially resolved themselves into a marine line of various styles of steering gears, with wheels in combinations of mahogany and other woods, boom jibers and bilge pumps for vessels, yachts, and more recently a heavy duty steering gear for fishing vessels, beam trawlers and work boats, together with a construction equipment line of hand and power diaphragm pumps, for both heavy and light duty, with portable units mounted on two-wheeled trailers. In keeping with the original Edson policy, the corporation maintains the production of Edson special suction hose, red seal diaphragms, and other pump accessories of the highest quality.

From the original one-man business started by Henry N. Stone in 1859, the concern has gradually and consistently expanded until today upwards of fifty men are employed, and the corporation has capital of \$109,000.

F. M. Weymouth is president, John G. Platt, vice president, and J. W. Wickwire, treasurer.

From the days of the clipper ships to the present, Edson steering gears and pumps have played an important part in marine circles, and many of these devices have been installed on cup defenders and other racing vessels, not only because of the speed with which they operate, but for their smart appearance as well, while the commanders of fishing vessels use them for their proven reliability.

THE COFFIN VALVE COMPANY

The Coffin Valve Company was founded by Zebulon E. Coffin, who began manufacturing valves and hydrants about 1859. The business was carried on in different locations in Boston for many years, before it was moved to its present location, in Neponset, about 1890. The principal output of the concern has been valves and their operating mechanisms for the control of water, in which field the company not only was a pioneer

but has been the leader in this line of work until its product has become recognized as standard and is constantly called for in specifications. It has continually taken the lead in the introduction of new ideas and improvements and is responsible for many of the designs of gates and operating mechanisms most favored by engineers today. Its policy has been consistently progressive and it has always kept step with the advancement in the sciences. The plant, consisting of a pattern shop, a cast-iron foundry, a bronze foundry and a machine shop, was ideally located and completely equipped and had facilities for providing and machining all types of iron and bronze castings from one pound to twenty tons up to the time of its destruction a few months ago. A new location was secured at the Victory Terminal and modern equipment was installed throughout.

The products include sluice and shear gates, gate, check, foot, gas and flap valves, and hydrants, and the company specialized in electrically and hydraulically operated valves.

Sales offices are maintained in New York City, Chicago, Philadelphia, Cleveland and San Francisco.

Charles R. Kelly is president, and Donald M. Belcher, treasurer and secretary and general manager. The corporation has capital of \$250,000 and employs upwards of 100 operatives.

SOME LOCAL ENTERPRISES OF THE FIFTIES

M. Hittinger, I. Cook, J. R. Nickels and C. E. Rymes, under the firm name of Hittinger, Cook & Co., established a machine shop, at the corner of Chambers and Water streets, in Charlestown, in the fifties, where stationary and portable steam engines were manufactured, and where shafting and mill work were produced. The portable engines were employed in pile driving, pumping, hoisting, discharging and loading vessels and in operating saw mills, and were produced in types of from five to fifty horse-power.

The Wm. B. D. Simmons Company occupied in the fifties a plant at the corner of Cambridge and Charles streets, in Boston, containing 12,000 square feet, six stories in height and equipped with a thirty horse-power engine, where the concern had produced by 1856 more than 500 organs, which were sold to customers in eighteen states of the Union and in the British Provinces.

In the fifties, the pyrotechnic laboratories of the Boston firm of Sanderson & Lanergan were the most extensive in the United States. The main factory of the enterprise was located in East Cambridge, where some three acres were enclosed, and where a number of buildings were devoted to production. Another laboratory was established at South Reading.

It was during the decade 1850-1860, that I. M. Singer began the manufacture of his sewing machine, in Boston.

WILLIAM H. TOWERS—A PROLIFIC BOSTON INVENTOR

William H. Towers, of Boston, one of the most versatile and prolific inventors of his age, belonged to that group which has given a distinctive character to the people of this section because of the fertility of their inventive genius, applied especially to the improvement of articles in common household or personal use. With one or two exceptions, his name appears upon the records of the Patent Office more frequently than any other,

generally in connection, it is true, with improvements in small articles, but among his inventions are some that formed the basis of large and prosperous manufacturing companies. His first patent was for an improved apparatus for giving rest to the arm in writing; his second for a hot-air register, which provided means for moistening the heated air to suit the occupants of a room and his third, for an improved horseshoe; with flanges to fasten it to the hoof without the aid of nails. He also invented a machine for opening oysters, and a creeper to prevent slipping on ice.

In 1860, he directed his attention to the improvement of brooms, and by combining strips of cane or reed with the corn, he succeeded in producing much more durable articles than any previously made, and which were later manufactured in large volume by the New England Broom Company.

In 1862, he conceived that the ordinary pin would be improved by making a slight spherical or oval enlargement near its centre, which, without interfering with its facility of penetration, would keep it in place, and not subject it to being easily or accidentally detached. On further experiment he found that the same object could be obtained by substituting two slight nicks near the point and he disposed of this patent to a group of Boston capitalists, who organized a company known as The Union Pin



WILLIAM H. TOWERS
of Boston

One of the most versatile
and prolific inventors of
the nineteenth century

Manufacturing Company. The concern operated twenty machines, each of which had a capacity of one hundred and sixty-five pins per minute, and approximately 200,000 pins were turned out each working hour of the day.

The same year he patented a combined cork and corkscrew, the latter consisting of a wire passed through the cork from its top to the bottom, and bent at the ends. Among his numerous other inventions was that of apparatus for heating rooms by gas, consisting of a sheet-iron drum cone, suspended over an ordinary gas burner.

But, probably, the most important invention which he made was that of a new process of tanning skins by means of alcohol. Sole leather was turned out by this process in less than thirty days, whereas under the methods then employed four months were required. Calf skins of the best quality were manufactured in from ten to fifteen days, while sweated hides were tanned into leather equally pliable with that obtained from limed hides, by this method, and the loss in weight consequent upon the

liming process was by this means saved. His later experiments were directed to producing from raw hide a substitute for hard rubber, and applicable to many purposes for which rubber was then used.

THE MORSE DIAMOND CUTTING COMPANY

Early in 1860 Henry D. Morse and Benjamin S. Pray established the Morse Diamond Cutting Company, the first establishment of its kind in America, locating the factory in Central Place, where they began the cutting of these precious stones by using natives of Holland—Messrs. De Young, Van Vollen, Cohano and Keiser, but as these artisans refused to teach American apprentices, Mr. Morse who was constantly building, rebuilding and perfecting steel and iron machinery to supplant hand operations, and who had become singularly expert at cutting and polishing, started a shop in Roxbury, where he employed twenty-three men and women. The firm was then known as Crosby, Morse & Foss, and in 1875 it was dissolved, and Mr. Morse located his factory, at 383 Washington Street, and a year before his death, in 1888, the firm operated as H. D. Morse & C. M. Foss.

The senior partner invented a double lathe, which enabled two diamonds to cut each other by attrition produced by rapidly revolving machinery, and the Morse gauge, an instrument for regulating all the angles to be cut on a diamond, both of which devices are in general use today, the former practically superseding almost entirely the old practice of cementing the diamond to be cut into the end of a stick, and rubbing it against another diamond of inferior quality, termed "bort," which was fastened into a stick in the same manner.

It was quite significant in the advance in the art of diamond cutting that the discovery by Mr. Morse, after years of study, that the proper proportion for a diamond's profile is one-third above the girdle and two-thirds below, was adopted by the European cutters, and his system seems to be established for all time. The acknowledged superiority of the Morse cutting is due to the part that all the light entering above the girdle is so reflected as to appear again above the latter. The old Dutch cutting, where little or no attention was paid to proportion, brilliancy, or shape, suffered a loss of forty per cent from the weight of the stone in the rough, and while the Morse system loses from 53 to 58%, the value of the gem is enhanced twenty-five per cent.

The Morse gauge tests everything until the stone is geometrically correct, and the cutter and polisher no longer trusted his eye alone for angles after it was invented.

THE W. F. SCHRAFFT & SONS CORPORATION

In 1861, the late William F. Schrafft, who had inherited from his ancestors the gift or the art of making products that were decidedly palatable to the taste, established the business which bears his name today, with a working force of four or five men and several girls. At the outset, pure gum arabic drops, much in demand by soldiers during the Civil War, chocolate vanilla creams, and certain kinds of hard candies constituted the largest part of the business—chocolate coated candy, such as dominates the confectionery trade today, being rare and expensive at that time. Cooking by steam was then in its infancy and gas for manufacturing purposes was unknown.

From the beginning the founder followed the unalterable rule of

using only the purest and best ingredients, and from his workers he exacted a degree of perfection which soon made his candy much sought after by those who appreciated its exceptional quality.

During the early years, the output was sold to local retail stores in Boston and vicinity. From this modest beginning, the business developed steadily year by year. As time went on, more attention was given to the manufacture of chocolates and this variety of candy grew rapidly in popular favor.

In 1895, the two sons of the founder, William E. and George F., were taken into the firm as partners, and the management of the business devolved upon them.

About that time steam came into more general use for power and cooking, and with the impetus given production by the use of machinery, the business developed very rapidly.

In 1895, and again in 1908, it became necessary to move to larger quarters, and finally in 1929, the magnificent reinforced concrete and fire-proof structure, with brick, tile and limestone front, 200 feet wide by 480 feet long, containing upwards of 675,000 square feet, or more than fifteen acres, modern in every respect, and surmounted by a massive tower, which rises 160 feet, was occupied. Two years were spent in its erection and installing the equipment in this building, which is a monument befitting the genius of the founder and his two sons—a temple of industry, and a real and lasting contribution to the development of the confectionery industry in America.

Here, the individual abilities of the many hundred workers, find expression in surroundings as nearly ideal as it is possible to maintain. In kitchens clean as those in the most fastidious homes, white uniformed employees, skilled in the magic of the confectioner's art, combine the finest of raw materials into dainty confections.

One outstanding reason for the success of the Schrafft Corporation lies in the fact that every detail of manufacture, from raw material to finished products, is controlled within the plant. This, together with the scrupulous supervision which is constantly maintained, to see that standards are never lowered, gives to Schrafft's products one of their greatest virtues—uniformity.

The Boston plant is the largest in this country engaged in producing fine quality chocolate candy and indicates beyond contradiction that Massachusetts is holding her place as the producer of the finest of confections.

Today, the Schrafft products are on sale in every one of the forty-eight states of the Union and in many foreign countries, and the growth of the corporation represents the development of an ideal developed by William F. Schrafft which was to strive for that degree of perfection that is always just beyond attainment.

The corporation has capital of \$2,000,000 and employs 1,600 operatives.

Throughout its long history it has remained in the hands of its founder and his descendants. William E. Schrafft is president and William V. Wallburg is treasurer.

THE AMERICAN AGRICULTURAL CHEMICAL COMPANY

The business of The American Agricultural Chemical Company, as it relates to Massachusetts, was established, in 1861, by William L. Bradley, who may be said to have been a pioneer in the fertilizer field for at that time commercial fertilizers were but little known in this country. Mr.

Bradley found the chief field for the sale of his products during the early years of the business in the southern states where commercial fertilizers were used very profitably in growing cotton. The sales in the northern states developed more slowly.

About 1874 the business was incorporated as the Bradley Fertilizer Company and thereafter the distribution expanded rapidly in New England, the Middle States and the Middle West. In 1899 a merger of several concerns was effected, and the Bradley Fertilizer Company became a unit of The American Agricultural Chemical Company, whose operations now extend over most of the country, east of the Mississippi River, and throughout the greater part of Canada.

From sales of less than 500 tons of fertilizer in 1861 the business has grown in volume to hundreds of thousands of tons. The original Massachusetts plant was at North Weymouth, where a large and modern unit of this company is still in operation.

THE AMERICAN TOOL AND MACHINE COMPANY

The American Tool and Machine Company is the original manufacturer of the belt knife splitting machine, for splitting leather, which it has manufactured without interruption, since 1863. The original model was developed only after the expenditure of large sums of money, and it has been steadily improved, particularly in recent years. The first machines ran at a speed of about 150 revolutions a minute, but those built today operate at the rate of 500 revolutions a minute. The versatility of the device is unusual as counter stock, shoe linings, calf, goat, and sheep skins, grain leather, bookbinding and bag stock, harness leather and belt butts, felt for hats, leather for carriage tops, enamel leather, green hides with hair or fur robes and coats, hides or skins from the lime, celluloid, and cow horns for combs, are all grist for the capacious maws of the machine.

The original product of the company was the Weston hydro-extractor, which it began to manufacture about 1858. In its Hyde Park plant it employs upwards of 350 operatives, and the corporation has capital of \$154,800. The Boston office is located at 10 High Street.

Frederick L. Claflin is president, Jacob Thaxter, clerk, and H. W. Woodworth, treasurer, and the company's operations include the mechanical engineering, iron foundries and machine fields.

The gift of several acres of land to Francis Skinner, and others, led to the formation, in 1862, and to the incorporation, the following year, of the Hyde Park Woolen Company, where army goods, blankets and flannels were at first manufactured. The plant was burned in 1873, and was rebuilt and occupied five years later, being known for many years thereafter as R. Bleakie & Company's woolen mill.

THE HENRY F. MILLER & SONS PIANO COMPANY

In February, 1863, Henry F. Miller, who had served an apprenticeship in the piano industry, and Joseph H. Gibson formed a partnership, and began the manufacture of pianos, the first seven or eight being given to some of Mr. Miller's artistic friends, which probably explains the genesis of many valuable and exquisite oil paintings that adorn the company's music rooms today.

In May, 1864, Mr. Miller purchased his partner's interests, and became one of the pioneer American producers of the square grand piano,

carrying the full 7½ octave scale, the concern ultimately occupying the entire building, at 611 Washington Street.

In May, 1880, his oldest son, Henry F., Jr., a graduate of M. I. T., became a partner and the plant was removed to a brick factory specially erected for the concern, in Wakefield, and following the graduation from Massachusetts Institute of Technology of the founder's other sons—Walter H., Edwin C., and William T. Miller,—they entered the firm, which became known as Henry F. Miller & Sons Piano Company.

Upon the death of Henry F. Miller, Sr., in 1884, the business was incorporated in order to facilitate the settlement of his estate.

At that time the Miller Company introduced a new style of period case, known as the "Colonial," which instead of having fancy carving upon the fretwork panels, a ¾ music desk, round toes and round cheeks, as had most of the pianos previously produced, appeared with a full desk, square toe and square pilasters and trusses, conforming to the era which it represented—the Colonial period. This innovation revolutionized the design of upright cases, and that change has continued through the industry, until today few period pianos are produced with round trusses.

About 1895 the company introduced the round legged Lyric baby grand type of piano, and ten years later the legs and the pedal lyre were changed to conform to the Colonial upright type.

Henry F. Miller, Jr., who had inherited his father's artistic genius devoted his attention from 1884 to 1895 to the erection of art or period cases, and he employed skilled architects to design replicas of early period productions.

In 1910, when the portable type of the player-pianola, as it was then known in the industry, had reached the point where it was accepted as a permanent adjunct to piano production, the Miller Company invented its player-action, and presented its first player-piano that year as the result of the inventions of William T. Miller.

In 1915, when the demand arose for a piano smaller than the Lyric type, Henry F. Miller, III, also a graduate of M. I. T., produced the Style B baby grand, four feet, ten inches in size.

In July, 1924, the company increased its size five-fold by purchasing the business and assets of the Smith, Barnes & Strohber Company, of Chicago, Illinois.

Among the features originated and controlled by the Henry F. Miller & Sons Piano Company is their patented key bottom, an open key frame reinforced by 3/8 of an inch channel iron, which prevents the key bottom from moving in any way and thus assists in maintaining the proper relation of both the grand and period actions.

The player-action, produced by William T. Miller, is manufactured under patents granted to the Miller Company, and the most recent device added to the company's product is the grand action bracket upon which patents have been granted in America and in Canada, the only attachment of its kind in existence which exclusively maintains the location of a grand action by making immovable the two vital points, or centres, namely; the flange pin of the hammer flange and the flange pin of the whippen.

The success of the corporation in the field of manufacturing period pianos led its executives to enter new domains in 1929, and probably it is the first producer of musical instruments in the United States to inaugurate a furniture branch.

That year it began the manufacture of Colonial, English and Italian furniture reproductions, and created a new department under the name of the Henry F. Miller Furniture Company to produce dining room and chamber suites, tables, chairs, and other specialties.

This course enables it to keep its expert cabinetmakers steadily employed, a problem which has been faced by every piano producer in the world since the introduction of the radio.

The company has its Boston studio at 200 Dartmouth Street, but all manufacturing operations are carried on at the Wakefield plant. G. Wilson MacDow is president and treasurer of the corporation, which has capital of \$2,500,000.

OLIVER L. BRIGGS & SON

During the Civil War, Oliver L. Briggs was engaged, at the corner of Boylston and Washington streets, in selling photographs, picture frames, stationery and croquet sets, the latter game developing into parlor croquet, which led him to engage in the manufacture of billiard and pool tables. Immediately after the war he abandoned the retail end, moved to the Boylston Market Building, at the corner of Boylston and Washington streets, and devoted all his energies to the manufacture of billiard and pool tables.

When the South End development started, he removed to a new building at 970 Washington street and remained there until the structure was torn down at the time the South Station was built. In the meantime, his son, Frederick H. became a member of the firm and the name was changed to Oliver L. Briggs & Son.

From 970 Washington Street, the firm moved to the corner of Essex Street and Harrison Avenue, where it remained until that location was acquired by the New England Telephone and Telegraph Company. The firm removed to the Boylston Building at 18 Boylston Street, where it remained until 1929, since which time it has been located at the corner of Washington and Avery streets, Nos. 581 Washington Street and 11 Avery Street.

During all these years the concern has confined itself to the manufacture and sale of billiard and pool tables, and has dealt in supplies for the same as well as in second-hand or rebuilt tables. Since the death of Oliver L. Briggs, his son, Frederick H., has been the sole owner.

L. E. MURAN & COMPANY

L. E. Muran & Co., is the successor of the business established in 1863 by E. A. Hammond, and carried on under the name of the E. A. Hammond Company, which was purchased by L. E. Muran, and was reorganized to carry on an extensive manufacturing stationery trade.

The assets of the Hammond concern included a modern printing plant, organized presumably for the production of office forms and for commercial job work.

Mr. Muran had built up a large business by selling direct to consumers such office commodities as blotting papers, rubber bands, Muran's adamant pens and Muran's Australian graphite pencils, prior to the time he acquired the Hammond concern, and since then L. E. Muran & Co., has become the Massachusetts agents of the Van Dorn metal office furniture, filing equipment, safes and shelving. The concern occupies the building

located at 288-290 Devonshire Street, has capital of \$60,000, and employs forty operatives.

L. E. Muran is president and treasurer, E. L. Gourley, vice president, and E. L. De Forest, secretary.

THE CHASE & SANBORN CORPORATION

Momentous problems of world-wide import have been settled over coffee cups, and the policies of nations have been fixed during the brewing of tea. More than a hundred years before the American Revolution, Charles II, of England, set about to close three thousand British coffee houses as hotbeds of sedition, in order to enforce one of his proclamations. But he soon found he must reckon with King Coffee.

A century later, a mere handful of Boston men, disguised as American Indians, consigned an historic cargo of 340 chests of tea to the depths of Boston Harbor, that original Tea Party, bordering on the edge of treason to the King, being but the forerunner of other revolutionary acts which were destined to culminate in the rise of a new nation in the western hemisphere.

The Massachusetts Bay Colony represented the head and forefront of opposition to England's colonial policy and it was in the old-time coffee-houses of Boston that many a plot was bred which ultimately shaped the destiny of the nation. They were the centers of political agitation and the rendezvous of fearless souls, whose names adorn the pages of history as tireless workers in behalf of American independence.

It is a far cry from the primitive decoction of the Colonial coffee-house of Boston, to the delectable demi-tasse or *cafe au lait* that today regales the palates of epicures, but to science in cultivation, to improved methods in manufacture and packing and to the ability of local coffee merchants to scientifically blend and roast the raw bean, is attributed the supremacy of Boston in the field of coffee.

CHASE & SANBORN

In 1864 Caleb Chase and James S. Sanborn founded the coffee enterprise now internationally known as Chase & Sanborn, the original headquarters being located at 34 Broad Street, where the concern remained until 1877, when larger facilities necessitated a removal to 85-87 Broad Street.

A year later Chase & Sanborn became the first coffee firm in the world to pack and ship roasted coffee in sealed cans, a lead seal being used for the larger packages of bulk capacity. In that year appeared the famous Seal Brand coffee—the first to be packed in one and two pounds cans.

In 1880 the firm opened its Western Department, at 39 Franklin Street, Chicago, and two years later its Canadian department, at 435 St. Paul Street, Montreal.

In 1892 the Chicago headquarters were removed to a larger building, at 76 East Lake Street, and the following year the company's Seal Brand coffee was served exclusively in the almost numberless restaurants and cafes at the Chicago World's fair.

It was in 1894 that the first automatic weighing machine known to the coffee trade was installed at the Boston plant, and a year later the concern introduced the use of parchment-lined paper bags as containers for coffee second only in quality to Seal Brand.

In 1903 the Boston headquarters were removed to a newly constructed building with increased space at the present location, 200 High and 141-149 Broad Street, and three years later the Canadian department was removed to larger quarters at 7-11 St. Helen Street, Montreal.

In 1923 the concern acquired a new Chicago home—the largest in America devoted to teas and coffees—at North Wells Street and the Chicago River. The building is 181 feet long on North Wells Street, 82 feet long on the river side and the same distance along the tracks of the Chicago & Northwestern Railroad Company, is nine stories high, with basement and sub-basement, contains more than three and one-half acres of floor space, and is built of reenforced concrete.

On December 17, 1923, a formal observance of the sixtieth anniversary of the founding of the business was staged, when a convention of representatives of this famous house, from all parts of this country and Canada, gathered in the Chicago headquarters, the eastern delegates making the trip in special cars attached to trains for that city, and being joined at points along the route by members of the sales organization, in New York, Ohio, and Indiana.

From the late eighties until 1913 the late Charles D. Sias, a man of farseeing vision and the practical ability to translate that vision into achievement was a great conservative force in all the firm's undertakings, and his was the guiding hand that placed the business on a solid and secure foundation. The methods employed, while forceful and vigorous, were always honest and broadly progressive, and the firm's position in the trade today, as well as the character and scope of its activities, may fairly be said to constitute the lengthened shadow of the dominant personalities of Messrs. Chase, Sanborn, and Sias.

In many respects the history of the house is unique. For sixty-five years outside interests never advanced a dollar towards its capital, formulated its plans or shaped its policies. The present partners are John Moir, William T. Rich, Frederick A. Flood, Harry L. Jones, F. Warren Kimball, and Charles R. Butler, with Carleton Moseley and Henry T. Brown, resident partners in Chicago and John Anderson, resident partner in Montreal.

Without exception they are men long identified with the business who have come up through the ranks, thus exemplifying in practice the policy of developing executives from within the organization, and fitting them for responsibilities to be later assumed by those of demonstrated ability.

In 1929 the firm of Chase & Sanborn affiliated with the Royal Baking Powder Company, of New York, but by the terms of the agreement the New England firm which had operated as a close partnership for more than sixty years, was incorporated as a new company, the Royal Baking Powder Company acquiring a substantial stock interest in the new corporation.

The partners of Chase & Sanborn continue their executive connections with the Chase & Sanborn Corporation, and Donald K. David, executive vice president of the Royal Company became its president. No new financing by either unit was required.

The Chase & Sanborn Corporation employs upwards of 250 hands, and is the largest distributor of teas and coffees in Canada, and handles a large business in these commodities throughout the United States.

In its long mercantile life the partners have observed the changing

conditions incident to the growth and development of the industry. They have witnessed the consumption of coffee jump from about 200,000,000 pounds in the early sixties to a present consumption of something more than 1,000,000,000 pounds a year, or to put it differently, from a consumption of about five pounds per capita in 1866 to something more than twelve pounds per capita today.

Thus it will be seen that notwithstanding the country's amazing increase in population, coffee has more than held its own, present consumption being, in fact, more than twice what it was in the years immediately following the close of the Civil War. Indeed, it is now at its highest point, each man, woman and child having more than twelve pounds a year, or about 500 cups allotted as the individual portion.

Several factors are responsible for this, aside from improved methods of cultivation of the coffee tree itself. By no means the least important have been the many modern mechanical devices which assure the excellence of coffee. Two score years ago teas and coffees for the most part were distributed and sold in bulk. The evolution from bulk to package goods was a forward step in merchandising. Particularly was it necessary that commodities so susceptible to deterioration as tea and coffee should enjoy every safeguard in the way of air-proof and moisture-proof protection.

THE GEORGE LAWLEY & SON CORPORATION

For more than sixty years Lawley-built yachts, of all tonnages, have sailed the seven seas, carrying into the ports of all lands the fame of a Boston firm that has made the building of pleasure craft its specialty since 1866.

Possessing a traditional love of the ocean, which, coupled with a positive genius for ship building, George Lawley, the founder of the George Lawley & Son Corporation, of today, was lured to America, from his native heath, London, England, with his wife and young son, George F., in 1851, just at the time that Boston and Massachusetts shipbuilding yards were seething with the launchings of the world's greatest clipper-ships.

His ancestors had followed the art of ship building for many generations before him, and George Lawley found little difficulty in obtaining work in the East Boston yards of that period, remaining here until 1866 when he removed to Scituate where he began constructing small boats, in company with his son, George F., under the firm name of George Lawley & Son, where a reputation was soon built for excellent workmanship and speedy craft.

In 1874, upon the invitation of several influential members of the Boston Yacht Club, the Lawleys moved to South Boston, occupying a yard adjacent to the club house, where they continued their work, and prospered. Many fine yachts were built here which, with the patronage of the club members, assured them a steadily increasing business.

In 1883, finding that their facilities were being outgrown, the firm purchased land on the north side of City Point, at the foot of O Street, and five years later moved the plant to this location. The firm was then the leaders of the few yacht builders in the vicinity of Boston. Having been associated with the noted designer, Edward Burgess, the latter turned over to the Lawleys the bulk of his new work, an arrangement which con-

tinued until Mr. Burgess' death, in 1891, and one that enhanced the firm's reputation.

At that time steel yachts were coming into vogue, and the Messrs. Lawley realized that if they were to meet the demand for this type of craft they must prepare for a steel construction plant, and associated themselves with Thomas Hibbard who had gained experience in that line, and securing some new capital, an addition was built to the plant, and the business was incorporated as the George Lawley & Son Corporation, with paid-in capital of \$100,000.

George F. Lawley became president, Thomas Hibbard, treasurer, and Edwin A. Lawley, clerk, of the corporation, the founder, George Lawley, having retired from active participation in the business.

When, in 1902, the City of Boston decided to move the house of correction to Deer Island, which property adjoined the Lawley Yard, the corporation bought it in competitive sale, thus adding largely to its facilities. Six years later, realizing that the water in the vicinity was becoming too foul for the high finishing of the ship work, and having a chance to dispose of the realty, the corporation sold the property to the Boston Elevated Railway Company, but remained in possession for two years, thereafter. In 1910, the purchase of the former Putnam Nail Works, at Neponset, was consummated, where the business is now located.

Mr. Hibbard, who had served as treasurer for twenty-eight years following incorporation, retired in 1918 and Albert E. Eldridge was chosen to fill his place. Frederic D. Lawley, son of George F., who had been connected with the firm for fifteen years as designer and engineer, became General Manager, thus relieving his father of many of his arduous duties. Mr. Hibbard remained on the board of directors.

In 1926 the Lawley interests were sold and a new board of directors was chosen. Mr. Hibbard was invited to take the presidency, and accepted. M. J. Kennedy, formerly cashier, became treasurer, Mr. Eldridge resigning, and E. H. Oxner, late superintendent of works, became general manager. Edwin A. Lawley continued as clerk of the corporation, which position he has held since its inception in 1890.

Under the new regime, the business has increased greatly, and there are more uncompleted orders on the books today than ever before in the history of the corporation. Should no more orders be received those on hand in 1929 were sufficient to continue operations at the peak, through January, 1931. With upwards of \$2,000,000 worth of contracts pending in 1929, the company found it necessary to install a 500-ton marine railway, another storage basin and additional wharves, despite the fact that \$62,000 had been spent the previous year in plant extensions and equipment.

Boatbuilding, the backbone of the early New England colonies, is again assuming an increasingly important place in Massachusetts industry. While the sixty or ninety-foot sloops or schooners of the earlier days nor the fleet clippers of the California gold rush and China tea trade eras are no longer produced, the internal combustion engine is bringing a new era to boatbuilding. Before the World War boats were largely custom-made, which made them very costly, but the congestion of the highways and increasing prosperity have conspired to turn the thoughts of many to the open sea, and shipbuilders, noting the success of standardization in the motor industry, began experimenting after the armistice on

new methods of production, and almost without exception their efforts have been crowned with success.

The spring of 1929 found forty-two New England boatbuilding yards constructing 307 yachts, ranging from small 22-footers to a 220-foot schooner, a 266-foot Diesel yacht, and a 343-foot turbo-electric yacht. Many of the artisans employed in local and vicinity shipyards today are sons or grandsons of the men who helped to make Massachusetts famous in the earlier times as producers of seagoing vessels. The love for their craftsmanship is aiding nationally in maintaining the Massachusetts tradition of product quality, and the state is forging to the forefront again in a new-old industry of supplying vessels for lovers of the sea.

Upwards of seven hundred men are carried on the payrolls at the plant, which embraces twenty-two or more distinctive departments, including an enormous sail loft, where sheets large enough for a circus top are tailored; a blacksmith shop, where all kinds of metals are wrought into intricate designs and shapes to fit the many craft constantly under construction; the joinery division, where wood-working is carried on as an art, rather than as a trade, and where much fine cabinet and hand-carving, ornamental moulding and paneling work for yacht interiors is executed; a completely equipped foundry; painting and decorating departments; welding and machine shops; a motor department, a mould loft, a spar shop, electrical and steel departments; a small boat shop, where tenders and launches up to thirty feet are built, as well as where class boats as large as the Q class and occasionally cruisers up to sixty-five feet in length are constructed; a main shop, 200 feet long, 80 feet wide, with a clearance space of 30 feet, where keels up to 190 feet in length are built under cover, and in front of which are many marine railways with capacities for boats of from 40 to 200 tons, and from 70 to 175 feet in length, together with four large basins and four big storage sheds, where upwards of three hundred and twenty-five boats of various types and sizes are sheltered during the winter months.

The corporation employs all of the modern methods of construction and few boatbuilding corporations in the United States can compete with the facilities for construction and repair work offered at the Lawley plant. Within recent years the corporation has made a specialty of producing yachts fitted with Diesel engines, and many of the contracts for private yachts have approached a million dollars.

The corporation has capital of \$100,000, and employs 450 hands. Thomas Hibbard is president; Edwin H. Oxner vice president, Edwin A. Lawley secretary, and Michael J. Kennedy treasurer.

THE REVERE SUGAR REFINERY

In 1866, at a period when helpful invention was in its infancy; when Morse's telegraph was but recently placed in operation; when Bell had not perfected the telephone; when Edison was an adolescent youth; when Marshall Field had just migrated West to establish the greatest retail business in the United States; when the application of steam to industry was in the bud; when railroad travel was slow and trans-Atlantic voyages were time consumers, and at the period when the Atlantic cable was being laid, the Revere Sugar Refinery was projected at East Cambridge, where it carried on continuous operations until late in 1918, a

period of exactly half a century, and at the time the plant was dismantled it had a melting capacity of 400,000 pounds of sugar daily.

In 1914 the United Fruit Company, that young corporation giant which today has a capitalization of \$100,000,000 actually issued and \$150,000,000 authorized, purchased the old Revere Sugar Refinery plant and five years later built on the Mystic River, in the Charlestown district of Boston, a refinery of the most up-to-date construction, equipped with the latest mechanical improvements, and embodying in its operations the highest engineering efficiency in sugar refining operation. Since 1919, this new unit has been operated as a subsidiary to furnish an outlet in the form of refined sugar for the output of its two raw sugar plantations and mills in Cuba.

The Charlestown plant is equipped with a wharf 645 feet in length and 130 feet in width, with ample berth room for two steamers, and a depth of thirty feet at mean low water. A fireproof store house located on the wharf, with a capacity of 20,000 tons of raw sugar, constitutes a part of the equipment, and in it is installed overhead electric cranes for the quick and economical handling of the raw products as it leaves the holds of the steamers.

The plant has a daily output of refined sugar of over four thousand barrels, and has direct rail connections thus affording distribution throughout the United States and elsewhere.

The Revere Sugar Refinery also owns and operates a modern cooperage plant in Cambridge, which has a daily output of 5,000 barrels and 4,500 wooden cases, and it markets its product to the confectionery and other manufacturing trades, to wholesale grocers and jobbers, either directly or through brokers, for domestic use, or through brokers for export.

While the primary area of distribution for the Revere sugars is New England, it is interesting to note that some sections of the United States, whose uninformed critics love to point out that New England is decadent, are today using in greater quantity the refined sugars produced at this plant than those manufactured elsewhere in the United States, this being particularly true of the region about Chicago, where the Revere product is marketed in large volume.

The Boston office is at 15 Broad Street. Victor M. Cutter is president; Henry E. Worcester, vice president; L. W. Udell, treasurer, and Arthur E. Nicholson, secretary of the corporation.

THE WHITE-SMITH PUBLISHING COMPANY

In 1867, shortly after the close of the Civil War, Charles A. White founded The White-Smith Publishing Company and began printing popular songs of the period which he believed reflected the sentiments and thoughts of the American people, and with W. F. Smith and J. F. Perry, formed the original firm of White, Smith & Perry. When Mr. Perry withdrew a few years later the firm name was changed to White, Smith & Co., and afterwards to The White-Smith Music Publishing Company, under which name the concern was incorporated in April, 1897.

It was the first house to reproduce music from engraved lithograph plates. Originally located at 516 to 532 Washington Street, the present site of the R. H. White Company, the concern removed to larger quarters at 62-64 Stanhope Street, where it erected one of the first and largest

plants in the country exclusively devoted to sheet and book music in all the varied forms and where a general business of music printing, engraving and binding for itself and allied trades was carried on.

In 1919 the company removed to 40-44 Winchester Street, due to the acquirement of extensive realty holdings by the city of Boston and the corporation purchased a five-story and basement structure of reenforced steel and concrete, which is used exclusively for the manufacture of its publications and those of many other publishers not equipped with printing or engraving plants of their own.

From 1867 until his death in 1892, Charles A. White wrote hundreds of songs, many of which, like "Marguerite," are sung today.

In 1892, Daniel L. White, son of the founder, became president of the corporation and at his death in 1919, his son, Charles A., was chosen president of the White-Smith Music Publishing house.

In the early years of the company, the White-Smith catalogue was limited but it has continued to grow until today it embraces a comprehensive line of music in almost all forms. It has sacred, semi-sacred and secular songs, quartet and chorus numbers for men's, women's and mixed voices, songs and hymns for patriotic and religious occasions, operettas and oratorios, and masses and vespers. The catalog also contains a complete selection of piano music, both classical and modern, musical primers, harmony methods, music for all types of instruments, both reed and wind, and organ music of the highest artistic merit.

Many of the noteworthy numbers include the compositions of such noted musicians as White, Vannah, McCarthy, Harts, Cadman, Bailey, Houghton, Eayrs, Ross, Blake, Russell, Johanning, Pflieger, Gronow, Loth, Heurter, Goldstein, Coerne, Eichberg, Hendricks, Dunn, Frysinger, Gillette, Stoughton, Loud and Lemare.

The corporation has its principal offices and plant in Boston, with branches in New York and Chicago.

Charles A. White is president and George F. Sliney is treasurer and secretary. The corporation has capital of \$100,000 and employs 100 operatives.

THE E. H. CLAPP RUBBER COMPANY

The E. H. Clapp Rubber Company had its inception in 1868, the original enterprise being the first to make a commercial success of reclaiming waste rubber, thus providing a product suitable for extensive use in the manufacture of rubber goods.

Eugene H. Clapp, with the coöperation of his cousin, Fred W. Clapp, and Leander R. Streeter, conceived the idea of melting or dissolving old rubber, but after some experimenting reached the conclusion that the most feasible way to reclaim the material was to grind it. The idea, first considered absurd, was developed on the property of a Mr. Perkins, who had a grist mill located on the Mill Dam, in the south end of Boston, where he ground corn and other cereals with mill stones. The experiments were uniformly successful.

The firm of Clapp & Co., consisting of Eugene H. and Fred W. Clapp, began the business of "grinding of all products which contained rubber, and the cleansing of the ground product of its worthless material for the purpose of preserving the rubber, a substance which can be used over and over again."

The mill was later established on an historic site, at Luddan's Ford, at Hanover, where one of the earliest manufactories for producing iron ore was established. For more than one hundred and fifty years the location had been noted for its anchor industry. The anchors for the frigate *Constitution* were forged there.

The plan of removing fibre from ground rubber by means of an air blast was later discovered, making it available for uses for which it had been considered unfit before.

It was found to be impossible to reclaim uncured friction by the air process and, after experimenting with various agents, sulphuric acid was adopted as the best means of reclaiming this kind of scrap. This was the beginning, on a commercial basis, of the so-called acid process.

In 1881 the factory building, known as the Old Forge, was entirely destroyed by fire. A much larger mill was at once built, and repeated additions have been made until the present establishment covers several acres, partly located in the town of Pembroke.

In 1892 Eugene H. Clapp died, and the business was incorporated as the E. H. Clapp Rubber Company with George A. Clapp as president and Arthur W. Clapp as treasurer. After the death of the latter, in 1907, the management was taken over by Eugene H. Clapp, Jr., son of the founder of the company, who is now its treasurer. George A. Clapp, son of the first president of the corporation, has held that office for many years.

The company employs about three hundred operatives, has capital of \$299,600, and manufactures extruded and molded rubber products as well as reclaimed rubber.

THE BOSTON ICE COMPANY

Few enterprises in Suffolk County have undergone so complete a transformation as The Boston Ice Company and still fewer have done so with less knowledge on the part of the public as to what was transpiring. Within a comparatively few years the company has substituted its business in natural ice 100 per cent with the manufactured product, it has modernized its methods of manufacture to the last degree, and its mode of distribution has likewise undergone evolution. While public attention has been focused on mechanical refrigeration, The Boston Ice Company has gone ahead quietly to supply the public with a better product and more of it—in short, to expand its business most progressively and aggressively.

Seven years ago the company was almost wholly dependent on the vagaries of the weather for its marketable product. Today it matters not what the weather may bring forth. Nothing is left to chance and there is never a threat of shortage for the supply of ice is carefully regulated to consumer demand, which is now a twelve months' problem since the importance of adequate refrigeration for foods is more widely recognized.

The first step in the transformation process began in 1909, when the company acquired a manufacturing plant at 34 Howard Street, now known as the Howard Street unit. Prior to that year The Boston Ice Company obtained all of its ice from natural sources. It held vast water properties in New Hampshire and Massachusetts and every winter harvested and stored great quantities of ice for use in the warmer months

of the year. When winters were long and cold the harvests were satisfactory and when they were not normal, the summer supply ran dangerously near a shortage point.

Until 1922 the process of switching from natural to manufactured ice made no further progress. The Howard Street plant which used steam power and produced ice from distilled water could manufacture only 200 tons per day, and the main source of supply was still from water properties. At the close of that year the plant was modernized to use raw water for freezing and electricity was substituted for steam power. In addition, the construction of a new plant was begun on Heath Street, and in 1923 it started operations with a capacity of 180 tons per day. From then on development became more rapid.

With sixty-one years of business life back of it The Boston Ice Company embarked on an ambitious program of modernization in 1927, which covered the disposal of water properties, the remodeling of older plants and the building of several new units. Nearby water properties were sold first because the spreading of the population made the ponds and lakes in suburban districts subject to pollution. As new plants were added to care for the ice requirements of Greater Boston, distant properties were sold. Since 1927 the company has disposed of all of its natural ice sources located in Dedham, Wellesley, Sharon, Wakefield, Ayer, North Chelmsford, North Grafton and Chestnut Hill, in this state, and in Newton Junction and Milton, in New Hampshire.

Coincident with the disposal of water properties six new plants were placed in operation on Albany and Hichborn streets and Dorchester Avenue, Boston; Maple Street, Chelsea; Second Street, East Cambridge; and Phillips Court, Malden. All employ electric power and the most modern methods of ice manufacture, so that today the ice producing capacity of The Boston Ice Company plants amounts to 1,500 tons daily, or translated into pounds, the weight in which we are most accustomed to regard ice, some 3,000,000 pounds.

While most of the plants have storage facilities to equalize the load which sudden demand may put upon them, there are other facilities for the handling of ice which aid in insuring Boston consumers with a steady supply. These include refrigerated sales stations in East Boston, Forest Hills, West Roxbury and South Boston, to which ice is carried from the manufacturing plants for local distribution.

Improvements in manufacturing technique have all been adopted with the aim of obtaining a better product more efficiently. The manufacturing process is simple, yet it requires a great deal of skill and knowledge. Filtered water, brine and ammonia are the necessary elements. The filtered water is frozen in large tanks and the greatest care is taken to produce a sparkling clear product. It is a known fact that water must be agitated throughout the freezing process in order to freeze clear, and to accomplish this an ingenious device sends a stream of air through the water while freezing to keep it ever in motion. This aerating system, as it is called, features all the company plants and enables the manufacture of a product which far excels the work of nature.

With a scientifically controlled production and the prompt adoption of every improvement which will make for a better product or better service, The Boston Ice Company now sets an example for others. Long

years of life have not robbed it of its vigor and it seems destined to do even bigger things.

It has capital of \$1,500,000 and employs 100 persons. Roland G. Hopkins is president; Charles D. Russell, vice president; C. E. Shirley, vice president and general manager; Howard M. Bartlett, treasurer, and Frank J. Bartlett, chairman of the board.

BROWN & WELLS, INC.

Brown & Wells, Inc., was founded in 1870 by George A. Brown, who until recently was active in its affairs. He established himself in business nearly sixty years ago on the corner of Otis and Summer streets with one sewing machine and a few pieces of silk, and sold and delivered his goods to local merchants, who, according to the custom of those days, usually paid in currency.

The business enjoyed a steady growth from the start, resulting in the formation a few years later of a partnership known as Cleveland, Brown & Co., at 11 Otis Street. In 1899 the firm name was changed to Brown & Cheever and larger quarters were taken at 80 Kingston Street.

In 1902 the partnership was dissolved and the business was continued by Mr. Brown individually until 1916 when a corporation was formed and that year Raymond Wells, now president and treasurer, entered its employ as clerk.

Successive changes have taken place in the past dozen years and the paid-in capital has been increased to \$150,000 to take care of the expansion in business.

Robert Wells is vice president of the corporation, which in 1919 moved to its present quarters at 39 Kingston Street, where it occupies most of the space for salesrooms and manufacturing.

These premises are within a few feet of where George A. Brown lived as a young man when he came from Newburyport to seek his fortune in Boston. At the time of the Boston fire, Mr. Brown was living as a young bachelor at the corner of Kingston and Bedford streets, but a short distance from where the catastrophe started. He reached the site of the fire just as the first steam engine, drawn by nine men, arrived. His household effects were moved to the Common, where they remained until the Sunday afternoon following the fire.

As a vivid reminder of the disaster the company has several statements and invoices of its customers in its possession which passed through the fire as their charred edges testify. The bills had been placed in the safe and as the floors burned the safe dropped to the basement and the contents were recovered when the fire cooled. In an effort to remove some of his merchandise to a safe place Mr. Brown found himself in the building entirely surrounded by flames, and only with difficulty was he able to escape.

Even in the early days the company went far afield, Mr. Brown's selling trips carrying him as far as Denver, Omaha and Minneapolis and he covered all of the larger cities such as Chicago, Cleveland, Louisville, Detroit and Buffalo, traveling with a large personal wardrobe and being absent for ten weeks. His wardrobe consisted of the conventional dark cut-away coat worn in those days, two or more silk hats and several canes.

The territory now covered includes the Eastern and Central West states. Goods are also shipped to Central and South America which trade is developing each season. In addition to silk fabrics of domestic manufacture, which are used extensively on popular priced neckwear, a substantial part of the business has developed into products requiring the highest grades of silk, thus necessitating frequent trips to the best markets of England, France, Switzerland, Czecho-Slovakia and Austria, where a search is made for the choicest designs and weaves in colors. Many designs are woven for the exclusive use of Brown & Wells, Inc., and it is the only cravat house in the Boston district that buys goods direct from European silk mills.

In 1870 most of the men's neckwear consisted of bows, hooked to the collar button by a wire, and plain and black string ties in narrow shapes. Puff ties were also worn by many well-dressed men, and the most popular model was named in honor of Lord Stanley, afterwards Earl of Derby. This was a broad flat scarf on the order of a puff, with a pearl pin in the center. Then came tecks, named for the Duke of Teck. There were various other shapes of puffs and bows, some with silk bands which went around the collar and were held in place by a pin, while others were bandless and hooked on the collar stud.

The uninterrupted success of the company has been due in no small part to always keeping abreast of the styles or perhaps a few steps ahead introducing new colors, new weaves and new designs with the idea of constantly bringing before the retailers novelty effects which prompt a ready sale.

THE UNIVERSAL WINDING COMPANY

In 1870 Hon. Joseph R. Leeson established the firm of J. R. Leeson & Co. to manufacture linen threads, and introduced the use of spliced threads, tying the different strands at intervals, maintaining the strength of the thread, and thus producing uniform work—a method which has now become general among all thread producers.

Recognizing that the tapered wax ends as made by hand were costly and lacking in uniform strength he introduced a patented, ready-twisted and tapered waxed end of uniform length and twist, and his repeated efforts toward improvements had the effect of raising the quality of thread used in shoe manufacture.

He secured the services of a well-known inventor who evolved the principle of winding now known as "Universal," and who invented machines embodying this idea. Fundamental patents on methods and machines were taken out in 1893, and Mr. Leeson that year incorporated the Universal Winding Company, which developed the business of scientific winding.

The demands of the textile industry for machines for accuracy in winding has increased to such an extent that the Boston concern is supplying its products to every center of the world. The company employs 1,500 operatives and is capitalized for \$2,222,000.

The Boston office is at 95 South Street. Joseph R. Leeson is chairman of the board; Robert A. Leeson, president; Edmund W. Converse and Frederick H. Bishop, vice presidents; Edward O. Smith, secretary, and Frank N. French, treasurer.

E. FRANK LEWIS

In 1870 E. Frank Lewis began the scouring of wool in a small two-story building in Walpole, with one wool dryer as his equipment, and with no assistants. A few months later two men were employed, and in 1883 he enlarged the plant, and employed forty operatives.

In 1888 H. Bradford Lewis became associated with his father, and since that year has been actively in charge of the business. It was deemed essential in 1890 to secure a new location where larger quarters could be available, and to install wooden machinery, and following an investigation of sites, one was selected on the south shore of the Merrimack River, in Lawrence, since which time three mills have been erected, together with seven stone houses with an approximate capacity of thirty thousand sacks of wool, and occupying a land area of approximately four acres. Five hundred hands are employed.

The founder, E. Frank Lewis, observed the eighty-sixth anniversary of his birth on April 1, 1929, and at that time enjoyed excellent health.

The Boston office and sample scouring plant are located at 242 Summer Street, and at the Lawrence mills wool is assorted, scoured, burred and carbonized.

JOSEPH MIDDLEBY, JR., INC.

In 1870 Joseph Middleby, Jr., for many years a well-known resident of Malden, founded the business known as Joseph Middleby, Jr., Inc., in a small way, cooking principally raspberry jam at the outset, which he sold to the bakers. He was his own cook, bookkeeper, office boy and truck driver, his daily procedure being to make the goods in the morning, deliver them to the bakeshops during the afternoon, and keep his accounts in the evening. After several removals he finally located at 201 State Street and still later he established a factory for the manufacture of jams, jellies and pie fillings in Charlestown.

Mr. Middleby was one of the first, if not the first, to make pie fillings for the baker.

In 1903 he sold his business to a corporation headed by Wallace M. Scudder of Newark, N. J., the present-day concern being the successor of that organization. Associated with Mr. Scudder were Messrs. E. Beverly Walden, of New York; William S. Olmstead, of Winchester, and Arthur T. Dooley, of Malden. Under their guidance, the business grew rapidly, and in 1907 the quarters on State Street were abandoned and at the same time the factory was moved from Charlestown, the entire business being centered under one roof at 337-347 Summer Street in a new building built and laid out especially for it.

In 1909 an additional structure was built at 327 to 329 Summer Street, these two buildings comprising the present plant, known as the Daylight Factory.

At the present sales are made to bakers, confectioners, ice cream manufacturers, soda fountain dispensers and retail and wholesale grocers, and the business has grown to where it comprises an extensive and extremely diversified line, which includes utensils and equipment such as are used by the above-mentioned lines as well as a complete line of the supplies required by them.

The Middleby Company has for many years maintained a New York

office and warehouse, and it also owns a strawberry packing plant at Princess Anne, Md., where a crew is sent each year to supervise the packing of strawberries for the year's requirements.

The company specializes in manufacturing pie fillings, mincemeats, flavoring extracts, jams, jellies, marshmallows and all kinds of fruit specialties and carries on an extensive business in jobbing supplies. Wallace M. Scudder is president of the corporation.

About 1914 Mr. Dooley severed his connections with the company and was succeeded by Karl H. Kalbfleisch, who became vice president and sales manager. In 1922 Mr. Walden died and the following year Mr. Olmstead, the treasurer, died, and George T. Butterworth, who had been with the concern since 1900, was elected to that office and still occupies the position. At the same time, Robert R. Bachmann became secretary and factory superintendent, which position he now fills.

The company takes special pride in the fact that many old-time employees are still in the Middleby organization, one man having worked for it and its predecessors for well over forty years, while two are in the thirty-five-year class and a long list in the twenty-five-year class. Many others have been employed between ten and twenty years.

The concern employs upwards of two hundred men and women and has capital of \$200,000.

W. S. BEST PRINTING COMPANY-CAUSTIC-CLAFLIN COMPANY

William Stuart Best was born in Medford, February 28, 1856, and at the age of fourteen years fell and injured his knee, the accident confining him to his home for over a year. During that time he became interested in printing and received a novelty printing press and some type from one of his relatives, so that it may be said in truth that the W. S. Best Printing Company was established in 1870.

Two years later he bought a Gordon press with ten-inch chase and afterwards purchased another of greater capacity. In 1874 he moved his presses to 48 Bedford Street, where he operated an office with W. H. Mandel, and in 1881 the business was transferred to 67 High Street, where Mr. Best installed three large cylinder presses. His first customer at that location was the *Shoe and Leather Reporter*. He also did embossing in gold, silver and Dutch metal under the firm name of Best Brothers, and in 1885 he purchased his brother's interest and moved the plant to 93 Federal Street, where he added two more cylinder presses to the equipment.

In 1894 the concern removed to 530 Atlantic Avenue, where it has since been located, and there, with the continued financial assistance of his brother, Edward H. Best, he added additional cylinder presses and greater equipment for all kinds of job printing. For a period the concern operated continuously on a twenty-four-hour day schedule, printing the *National Magazine*, the *League of American Wheelmen Magazine*, *The Investigator*, railroad time tables, Boston hotel menus, books, maps and all kinds of commercial job work.

In 1908 Philip W. Carroll acquired an interest in the concern and remained with it until it was disposed of to the present owners and the founder died in 1918.

In 1902, the Caustic-Claflin Company was incorporated by Charles E. Caustic and George W. Claflin. Ten years later the latter died. In

1911 William Ledyard purchased Mr. Claflin's interest in the business and during the following ten years the company experienced a constant growth.

On March 1, 1922 the Caustic-Claflin plant, at Harvard Square, Cambridge, was completely destroyed by fire and it became necessary to immediately secure facilities to carry on business. On March 17, of that year, the assets of the W. S. Best Printing Company were purchased by Messrs. Caustic and Ledyard. To conserve the business of both companies the firm is known as the W. S. Best Printing Company-Caustic-Claflin Company, Consolidated, and carries the "Best Print Boston" as its registered trade-mark.

Thus two old enterprises, respectively for fifty-nine and twenty-seven years, having borne excellent reputations for the quality of their work, still continue to produce a considerable volume of distinctive high-grade commercial printing of all descriptions.

Fifty hands are employed.

THE BROWN-WALES COMPANY

In 1870 John G. Brown and Josiah Bacon founded what today is known as the Brown-Wales Company, having its first establishment on Fulton Street, and later removing to Purchase Street, where it remained until 1912 when the present location at C, Fargo and Egmont streets was occupied, in the heart of the wool district. During the World War when a demand arose for increased space in its plant, the company began a warehouse development, in Dorchester, which it has increased to a great extent since that time. The company also operates branches in Providence, R. I., and Lewiston, Me., and recently it opened a service station in North Cambridge, where plumbing and steam supplies are carried. The main warehouse, located on the Midland Division of the New York, New Haven & Hartford Railroad Company is served by a spur track, and the concern specializes in all kinds of bar iron, structural steel, tin plates, sheet iron, metals, roofing materials, and plumbers', steam and gas fitters' supplies.

William Q. Wales is president and treasurer; Quincy W. Wales, vice president, and William H. Shurtleff, secretary. The corporation has capital of \$300,000 and employs 100 operatives.

THE B. F. STURTEVANT COMPANY

In the list of founders of the present industrial supremacy of Massachusetts, the name of Benjamin Franklin Sturtevant will forever find a prominent niche in the hall of fame. Like many of his predecessors and successors, who conceived and created great industries, he rose from humble surroundings, to make his name synonymous with a world-wide field of manufacture, and fortunately, he lived to witness his ingenious inventions placed in the service of mankind from pole to pole, and to observe the business he created obtain dominion over the field he marked as his own.

His life story is another romance in the industrial history of the Commonwealth which demonstrates that, following the call of his inventive mind, he cast aside the leather apron and the awl, badges of the shoemaker's art, and was the first to conceive and then create and next to direct one of the largest industrial enterprises of Massachusetts, and

one which today, with increasing usefulness, produces for all lands under the sun the great bulk of the manufactured commodities within its special field.

Recognition of his inventions and manufacturing skill came quickly, for among the early orders on the books of the B. F. Sturtevant Company was one calling for the special design and installation of a powerful ventilating blower for the United States Capitol, at Washington. The operation of some of the pegging machines invented by Benjamin Franklin Sturtevant raised a dust, which caused protests on the part of the workers and the inventor realizing that this must be corrected, he conceived a simple blower to fan the dust away.



WHERE BENJAMIN FRANKLIN
STURTEVANT STARTED THE
STURTEVANT BLOWER WKS.,
BOSTON, IN 1876

Selling his rights in the pegging machine, in order to raise funds to develop and manufacture his fan, he began business in a modest little shop on Sudbury Street, Boston, with half a dozen men, struggling along to perfect his devices to master the air. In the Centennial Year he had progressed far enough to build at Jamaica Plain, what, at that period, was regarded as a big plant, but in less than a decade it was more than doubled.

Within five years thereafter the Sturtevant works were again increased to twice the size they had become when the former additions were completed.

Unfortunately, B. F. Sturtevant was not permitted to live to witness the next change, the removal to the new site at Hyde Park, in the early years of the present century, which was soon covered with immense shops and foundries, affording upwards of twelve acres of floor space for manufacturing purposes, with every mechanical installation for skilled and efficient production.

It is indeed a far cry from Mr. Sturtevant's original idea and the 75 cents in assets he possessed when he landed in Boston, from Maine, to the \$3,750,000 capital, and 2,000 employees of the present-day B. F. Sturtevant Company, especially when one realizes that when the founder built his first blower there was no general demand for such apparatus.

Today, in its special field of service, the B. F. Sturtevant Company is the largest manufacturing establishment of its kind in the world, as well as one of the leading industrial enterprises of New England in the size of its plant, the number of its workmen, and the amount and value of its output.

The entire growth of the company has been a consistent evolution. The Sturtevant fans required direct drive when built in large sizes, and the Sturtevant automatic engines were developed. As ventilating and draft fans, especially those in naval and marine service, must be absolutely unfailing, these engines were developed to give positively reliable and continuous service with the minimum of attention, and the famous "Navy Steam Fan" was evolved.

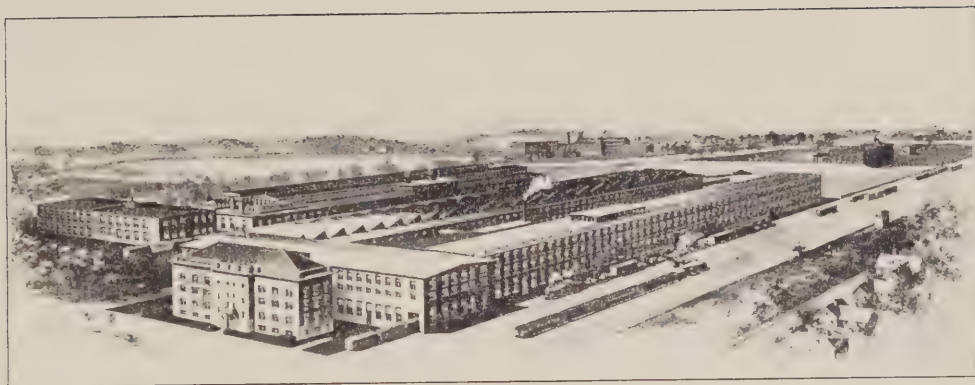
Next, the electric drive, essential for use with some kinds of fans was developed at the works into the well-known Sturtevant motors, generators and generating sets.

The Sturtevant steam turbine followed in due time, and then the company armed itself to attack the great basic problems of fuel economy. Mr. Sturtevant, Ex-Gov. Eugene N. Foss, who succeeded him in the management of the business, and their associates recognized that in every power plant there was a large percentage of avoidable fuel-waste. To furnish the ideal method of preventing this loss required only the suitable application of a blower in connection with specially designed means of utilizing the heat saved. And thus arose the Sturtevant systems of mechanical draft and fuel economizing, together with the comprehensive series of power-generating and utilizing apparatus known everywhere today under the name of the founder of this enterprise—the most notable outgrowth of its activities.

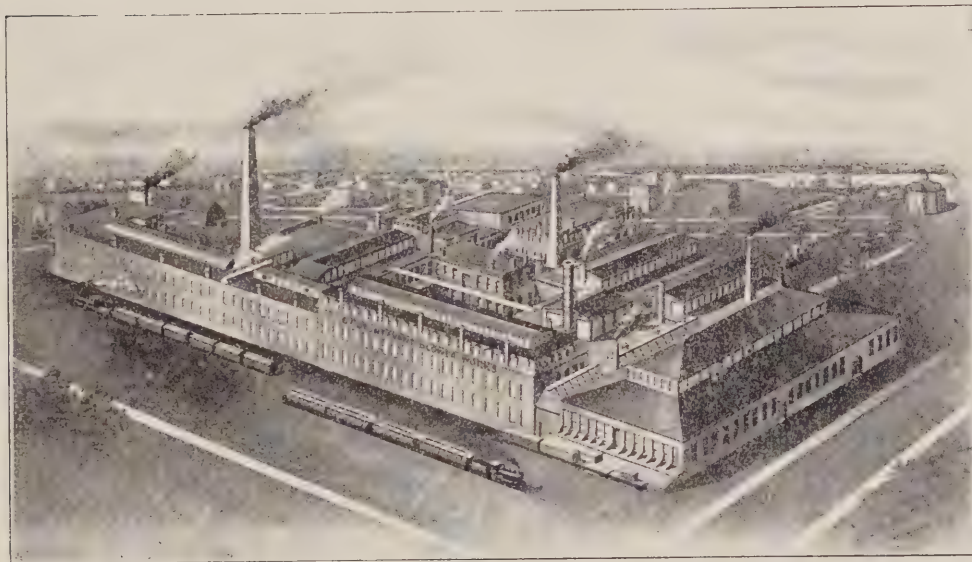
The company owes no small part of its present-day success to the faith of its principal owner, Former Gov. Eugene N. Foss, and his associates, as well as to the skill of Massachusetts workmen, and to the industrial soundness and vigor of this section as the logical center of high-grade, skilled mechanical engineering.

A firm believer in the fact that this ancient stronghold of the skilled artisan is impregnable from successful attack from the outside, Former Governor Foss has so managed the affairs of the company as to carefully maintain the quality standard of its products by insisting not only upon the fair and equitable utilization of labor and by using the best raw materials in fabricating the most efficient types of machinery, but also by accumulating and disseminating useful and pertinent engineering data acquired after the most painstaking and thorough research activities, thus proving by precept and example the right of the enterprise with which he is identified to the confidence of engineers, the users of power, and the consuming public.

In determining the policy of the company each step has been predicated upon the recognition of a definite industrial need, and the product has been gauged upon the highest attainable means to that end, by maintaining a highly efficient business organization, with branch offices



B. F. STURTEVANT COMPANY (Hyde Park), BOSTON, 1928
Erected in 1902



THE JAMAICA PLAIN PLANT OF THE B. F. STURTEVANT COMPANY

and agencies throughout the world. The enterprise has been a distinct factor in enabling the industrial world to save uncounted millions of dollars at an insignificant cost of installation and operation of the mechanical draft and fuel economizing apparatus it has produced.

It has not confined its operations to one line, but has applied its products all over the world in the manufacture of paper and fabrics, in the drying of lumber, chemicals and innumerable other commodities, in forcing the fires of steel mills, in cooling the airs of public buildings and houses, or in heating them when it is cold, in drying and moistening it as required, in separating and conveying grains, pulverized materials, flour and foodstuffs, and in short in making weather and climate to order, employing air to save fuel and power, and to aid health, to convey loads at the rate of a mile a minute, to lift grain a distance of forty or fifty feet, to feed fine dust to the boilers of coal-breakers, to throw off noxious gases that menace the lives of workers in chemical industries, to banish fine chips that formerly cut the membranes of the lungs of metal operatives, to separate the wheat from the chaff, to pull sparks out of smoke and to manufacture apparatus so intelligent in operation as to distinguish popped and unpopped corn in a fritter factory.

When the engineers of the Holland vehicular tunnels designed these immense transportation arteries connecting the states of New York and New Jersey their greatest problem was to devise measures that would remove the deadly carbon monoxide fumes emanating from the exhaust pipes of the almost countless automobiles traversing the tubes every second of every twenty-four hours, and they turned to the B. F. Sturtevant Company for the apparatus that could make the tunnels serviceable, with the result that approximately \$750,000 worth of air conditioning devices from the Hyde Park Plant entered into the equipment of the project. The eighty-four giant blowers, the lungs of the Holland Tunnel, handle 1,400 tons of air a minute, giving an air change forty-two times each hour, fresh air being circulated upward from beneath the floor of the tunnel, while used air is exhausted overhead.

The B. F. Sturtevant Company has capital of \$3,750,000. Hon. Eugene N. Foss is president; E. B. Freeman, vice president and general manager; Noble Foss, secretary, and B. S. Foss, treasurer.

THE PILGRIM AND BEACON PRESS

The Pilgrim Press of 14 Beacon Street confines itself mainly to books of a religious and inspirational nature, and has maintained a place of high prominence in that field for a century. Though the Pilgrim Press is the name by which it is popularly known, the official designation since 1870 has been the Congregational Publishing Society. It is an offshoot of the Massachusetts Sabbath School Union organized in 1825, and has been publishing books ever since that year. The union included both the Congregational and other denominations, but that partnership was dissolved in 1832, since which year each has maintained its individual identity. In the 105 years since 1825 there have been but four men in charge of the publishing business of the *Congregationalist*, and Dr. Sydney A. Weston has been general manager and editor for the past twenty-five years.

The Beacon Press of 25 Beacon Street is to the Unitarian denomination what the Pilgrim Press is to the world of Congregationalism, al-

though it publishes some general books as well as those religious and inspirational in nature. It was established in 1914, and is in charge of W. Forbes Robertson.

THE SAMUEL WARD MANUFACTURING COMPANY

The story of the Samuel Ward Manufacturing Company is that of a retail store becoming a highly successful manufacturing enterprise, quite the opposite experience of the average factory which occasionally expands by the opening of its own retail stores to market its products.

When Samuel Ward graduated from Amherst College, in 1868, he scarcely visioned an expansion of the business in which he was to engage that would embrace, in less than six decades, the occupancy of a six-story concrete manufacturing plant, with offices and salesmen carrying the Ward line into every one of the forty-eight states of the Union. But the germ of manufacturing was planted in his modest little retail shop about 1870 when he began mixing inks and when he ordered pencils and erasers carrying his name made for his store. Soon after he inaugurated his essay in the stationery field, he added an old-established firm located at 8 State Street, and a few years later another at 58 Washington Street, thus affording access from two streets to his shop.

Some five years after he consolidated his business with that of Richard L. Gay, under the firm name of Ward & Gay, in the eighties, Mr. Ward began a jobbing enterprise in the basement of a new store, at 180 Devonshire Street.

It was in the late '70s that an interesting development in the paper end of the business was made by him, and one that had a marked effect upon the stationery trade in its entirety. Prior to this time Ward stationery was sold almost exclusively by the quire. Mr. Ward argued that he bought paper by the pound and he saw no reason why he should not sell it by the pound. He announced his policy, and it proved successful. Soon two long counters, extending the entire length of his store were piled high with "pound papers," the envelopes being ranged on shelves under the counter. Fashionable equipages were drawn up daily for forty feet on each side of the entrance to his shop, and while he handled papers bearing about every trade name, he consistently popularized the name Ward by offering such brands as Boston Linen, Bunker Hill Bond, and Sawaco Linen.

In 1886 Ward & Gay dissolved partnership, and the Samuel Ward Company was formed, and the following year the concern moved to 49-51 Franklin Street, where a five-story and basement building was overtaxed to capacity by the rapidly-growing manufacturing, jobbing and mail-order departments. It was at this location that the company made its original installation of machinery for the conversion of flat stock into social stationery and envelopes. Imprinting and die-stamping machines were added, and with the innovation of power-driven engraving presses, these machines were purchased and became the nucleus of the present completely-equipped engraving department.

About 1892 or 1893 the company began the manufacture of its famous "A Line a Day" book, and just at the dawn of the present century a sales office was opened in New York City.

In 1903 the company removed to 57-61 Franklin Street, where a five-story and basement structure, with twice the floor area of the previous

plant, was occupied and a few years later additional floors in adjoining buildings were acquired for Ward's engraving plant, and for the manufacture of leather goods. In 1910 eighteen new stockholders, all employees, were taken into the company, many of the members having been with the concern since boyhood. This policy cemented the relations between employers and employees—relieved the officers of the company of much detail, and afforded opportunity for a division of responsibilities.

Three years later a six-story, fire-proof structure was erected at 299-303 Atlantic Avenue, to which all the manufacturing departments were moved, and at about that period sales offices were opened in Chicago and San Francisco.

In 1928 added facilities were imperatively demanded, and the entire building at 29 Melcher Street was purchased, providing floor space nearly double that at the Atlantic Avenue plant.

Prior to the death of the founder, in 1918, John D. Lamond, who for many years had been general manager, was elected president, and the other officers are Waldo H. Rice, vice president and general manager; Arby C. Whittmore, treasurer, and John T. Bailey, clerk. The corporation has capital of \$325,000 and employs 250 operatives.

THE TATE MANUFACTURING COMPANY

For fifty-eight years the Tate Manufacturing Company has been engaged in the manufacture of picture wire, and for many years it has been a leading producer of quality mops of all kinds, dust absorbing fabrics, and braided clotheslines. The latest addition is the manufacture of a high-grade line of all cotton oval braided rope.

Stove pipe, copper, brass, tinned, black galvanized, enameled copper magnet, and braided antenna wires on spools or in coils are produced, as well as cotton floor and bristle brushes.

In 1909 when the concern was incorporated the name was changed from the Tate Wire and Manufacturing Company to the Tate Manufacturing Company.

It distributes its products to the hardware, woodenware, department stores, and printer trades, and to some of the largest five-cent to one dollar chain store syndicates in the United States, and employs fifty operatives.

R. H. Blake is president and T. D. Reynolds is treasurer of the corporation.

BRAY-STANLEY & ELLIS, INC.

In 1872 Elisha Thayer began the manufacture of shoes in Boston, and nineteen years later Henry, Damon & Sprague bought the business, which continued under that designation until 1903, when it was acquired by Damon & Ellis, Inc.

In 1894 Bray & Stanley began the manufacture of shoes in Beverly, and in 1924 the Boston and Beverly concerns were amalgamated as Bray-Stanley & Ellis, Inc., and now has capital of \$100,000.

In its factory at 93 Albany Street, 2,000 pairs of men's and women's McKay warm-lined winter footwear are produced daily, and 150 operatives are employed. The concern sells only to wholesalers.

Moses Ellis is president; Ralph D. Stanley, treasurer, and Harry Stephenson, clerk.

THE CHARLES E. LAURIAT COMPANY

In 1872 Charles E. Lauriat, who had served an apprenticeship in the book store of William Veazie and William H. Piper & Co., for seventeen years, formed a partnership with Dana Estes, under the firm name of Estes & Lauriat, and acquired the stock, good-will and lease of the store formerly occupied by W. H. Halliday & Co. at 143 Washington Street, and became the New England agents of D. Appleton & Co., of New York City.

In 1898 the partnership was dissolved, and the Charles E. Lauriat Company was formed, with Charles E. Lauriat as its president. In 1906 larger quarters were taken at 385 Washington Street.

THE E. VAN NOORDEN COMPANY

One of the oldest industries of its kind in point of continuous service is the E. Van Noorden Company, manufacturers of skylights, ventilators and sheet metal products, having been founded in 1873 by E. Van Noorden who, as a young man, came to Boston because he foresaw a period of building activity following the great fire of November, 1872.

He admits that for a time he was but one stride ahead of the sheriff, but he managed to "hang on" until the manufacture of sheet metal skylights became an established practice.

Previously the frames had been made of wood or iron, with no consideration of condensation drainage or petty leakage, and a skylight was a tolerated evil to be avoided except where overhead light was absolutely necessary.

The idea of forming skylight bars of sheet metal with provisions for drainage in each member, originated in England, and was introduced into this country under the so-called Hayes patent, Mr. Van Noorden being the first New England licensee under the patent. The use of sheet metal for skylights became widespread, and as the Hayes Company offered no protection to him, Mr. Van Noorden developed the Van Noorden sheet metal skylight, and improved on the Hayes construction.

Again in 1902 when rolled steel skylights, combining rolled steel for strength and sheet metal for weather protection, were first introduced, due to larger skylight areas, the Van Noorden Company was a pioneer in the development of this type of skylight construction.

The rigorous character of the New England climate has been a factor in developing Van Noorden weatherproof and drip proof skylights, but during the past twenty-five years Van Noorden skylights have been installed all over the United States, in Canada, Panama and Porto Rico, and in Chili and Peru, South America.

Today, in addition to the manufacture of skylights, the company specializes in the manufacture of ventilators, door bucks, Kalamein work and pressed steel stair work, in copper roofing and in all kinds of exterior sheet metal work. The long experience of the concern, combined with its modern plant and equipment, enables it to perform work of the highest quality.

William G. Kiefer is president; E. Van Noorden, treasurer, and Carl L. Mittell, vice president. The corporation has capital of \$1,000,000 and employs 150 operatives.

THE JAMES RUSSELL BOILER WORKS COMPANY

In 1874 when James Russell and Edward Lally established their modest little shop at C and West First streets, in South Boston, neither foresaw the twentieth century development that would be attained by the enterprise, which for three generations has been under the management of the Russell family.

Originally founded to fabricate locomotive boilers, the products have changed as business demands required until today the concern ranks as a leader in the electric welding field, while many of its employees who have contributed their skill to its success under representatives of these three generations have not only witnessed a remarkable transition in the field of boiler manufacture, but have readily adapted themselves to the new methods of production, thus showing the versatility of the skilled mechanics trained in this Commonwealth.

In 1882 Mr. Lally retired from the firm, and it was operated as James Russell & Son Company until incorporated as the James Russell Boiler Company in 1890. Among the early customers were the Fitchburg, Boston & Providence, and Cheshire Railroad Companies, and James Russell became the accepted leader in locomotive boiler construction of his era. His products entered the engines used on the Illinois Central, the Chicago & Northwestern and the original Milwaukee & St. Paul Railroads, and, in fact, on nearly all the large systems throughout the country.

By 1917 a new plant became a necessity, and eight years later a large addition to it was required. During the World War, the process of electric arc welding was developed and applied to many new uses. Realizing its possibilities the Russell concern was among the first to adopt the process and to install its first welding unit. As the field broadened it added new units until it now operates twelve machines. Appreciating the limitations of any new development, the company's executives were careful to use welded construction only where they were thoroughly convinced of its adaptability. In the last ten years the concern has designed and built some of the largest welded structures and tanks in this part of the country.

It is now manufacturing an improved firebox boiler, for low pressure heating, by this latest improved method.

The Russell products conform to the code of the American Society of Mechanical Engineers applying to low pressure heating boilers and also to all the requirements of the Commonwealth of Massachusetts, and are built in standard sizes, each of which is very conservatively rated for both steam and hot water. They are furnished with plain furnaces for use with the usual forms of anthracite coal or with downdraft furnaces to give smokeless combustion with bituminous coal.

Provisions are made for the connection of automatic feeders when boilers are to burn oil or are a part of a vacuum heating system which uses a pump to maintain its vacuum, and in accordance with Massachusetts laws.

While the company originally manufactured railroad equipment, its business soon extended to the stationary field for heating and power, which necessitated the construction of stacks, flues and tanks in conjunction with boiler work.

For years one of its allied lines was in the field of sugar machinery,

and today its equipment can be found in nearly every sugar refinery in North America as well as in most of the plantations in the West Indies, South America and the Far East.

The burning of fuel oil brought orders to the company for many large built-in-place storage tanks, the largest of which was installed in the Equitable Building, in New York City. This installation, made in 1923, was of the concern's own patented design for 150,000 gallons capacity, of all welded construction.

The broad and varied experience of the Russell enterprise in fabricating steel plate, has placed the organization in a position where its recommendations and designs are accepted by some of the largest users of its products. Everything that can be made of steel, either riveted or electric welded, is within the range of its production facilities.

Many of its products entered into the new Revere Sugar Refinery, while its sugar mixers have been installed in Cuba, Colorado, and far distant points.

The corporation has capital of \$49,000 and employs upwards of sixty operatives.

A. W. Russell is president; M. W. Russell, treasurer, and W. K. Russell, secretary, they with Gordon W. Russell constituting the board of directors.

THE ORPIN DESK COMPANY

In 1874, Fletcher Orpin began the manufacture of desks on Richmond Street, Boston, and a few years later, when a brother of the founder joined the firm, the name of Orpin Brothers was adopted, which designation continued until 1919, when the Orpin Desk Company was incorporated.

It now occupies a modern factory at 121 Medford Street, Charlestown, with waterfront privileges on the Mystic River, and the plant is equipped with the latest machinery. The enterprise ranks as one of the oldest, if not the oldest, desk concerns in New England.

Show rooms and sales offices are maintained on the street floor at 209 Congress Street, Boston. The corporation numbers among its customers, Harvard, Dartmouth, Amherst, Tufts, Simmons, Middlebury and Boston Colleges, Boston University, and the Universities of Maine, New Hampshire and Vermont, as well as Exeter Academy, and many private schools.

When Sears, Roebuck & Co. opened its magnificent Boston retail store on Brookline Avenue, the Orpin Desk Company was chosen to fill the order for the complete desk equipment.

Sidney Stevens is president and treasurer, and W. P. Jones, vice president and general manager, and H. P. Mason, secretary of the corporation, which has capital of \$300,000 and employs 100 operatives.

W. A. WILDE & CO.

The firm of W. A. Wilde & Co. was founded in 1874 by the father of the present head of the concern, Allan H. Wilde. Associated with the latter, until his death in 1928, was W. Eugene Wilde. It is in the field of religious publications that the concern has become internationally famous, and perhaps no product is better known than "Peloubet's Select Notes," a commentary on Sunday School lessons for teachers, and used

the world over, the 1929 edition being the fifty-fourth annual volume of this work. The house has also specialized in books for young readers, such popular authors as Walter Prichard Eaton, Arthur C. Bartlett, William Drysdale and Amy E. Blanchard being represented on its list.

THE HOLTZER-CABOT ELECTRIC COMPANY

Charles W. Holtzer, a native of Karlsruhe, Germany, received his education in the Institute of La Fontaine, in that place, served an apprenticeship as a machinist, and came to the United States in 1866, at a period when interest in military devices was still in evidence as one of the aftermaths of the Civil War.

He first carried on experimental work in connection with the timing of explosive projectiles, following which he spent some years in the employ of E. S. Ritchie & Sons, of Brookline, in the manufacture of various instruments, and in 1874, formed the firm of Holtzer & Newell to engage in the production of simple electrical devices. A year later he established a business of his own, still dealing with electrical apparatus, and operated the first suburban telephone exchange outside of Boston, the enterprise having fourteen subscribers and one toll line to the Hub.

His first shop was in the basement and street floor of the Harvard Building, in Harvard Square, Brookline, where he remained for four or five years, following which period he erected his first factory on Boylston Street. In 1885 he purchased an old church on Station Street, opposite the Brookline depot of the B. & A. Railroad Company, remodeled it in part for manufacturing purposes, and leased the balance for offices and club rooms, but in a few years he required the entire floor area to handle his growing business.

For a time just before Mr. Holtzer acquired the church property, the concern operated under the firm name of Seth W. Fuller & Holtzer, and following the opening of a Boston salesroom, George E. Cabot became a partner, and the firm name was changed to Fuller, Holtzer & Co., but in 1889 this concern dissolved, when Mr. Fuller withdrew to engage in electrical contracting, and that year The Holtzer-Cabot Electric Company was incorporated, and moved its Boston office from 111 Arch Street, to 92 Franklin Street. Three years later Mr. Cabot sold his interests to Mr. Holtzer.

In 1897, an office building of brick, four stories high was built adjoining the plant and two years later, additional manufacturing space being required, a brick wing 30 feet by 60 feet, four stories high, was erected, followed shortly by a second wing of about the same size.

In 1903, so great was the pressure for floor space, a brick wall was built from the brick office wing on the left to the factory wing on the right, and each floor was carried out to it, thus gaining a substantial amount of additional manufacturing space.

In the meantime, the motor business of the company had increased to such a point that it could no longer be accommodated, and there being no more available land adjacent to the factory, a building 80 feet by 100 feet, five stories high, on Albany Street, Boston, was leased, and was devoted entirely to the manufacture of electric motors.

In 1911 a large portion of the Brookline factory was destroyed by fire, and in order to provide temporary quarters, a number of floors were leased on Bristol Street, Boston, and elsewhere, while the main plant



FIRST FACTORY OF THE HOLTZER-CABOT ELECTRIC
COMPANY, BOYLSTON STREET, BROOKLINE
Occupied in 1880



PRESENT PLANT OF THE HOLTZER-CABOT ELECTRIC COMPANY (Roxbury),
BOSTON
Built in 1915

was being rebuilt. By the time this was accomplished, increases in the business had taken place and the Bristol Street space was retained until 1914 when all departments were moved to the new Amory Street plant.

During these years, the need was becoming more and more apparent for a single manufacturing unit to house the scattered branches and to provide greater facilities, and in 1913 plans were completed for a modern plant, the last word in convenience, in sanitation and completeness. A year was required in building and about the same period was necessary for moving and the close of the year 1915 found the company practically installed in its new quarters. The main building is a six-story structure of reinforced concrete, with an annex of seven stories, containing the service section and certain of the manufacturing departments. The plant contains, with its auxiliary departments, about 150,000 square feet of floor space. The clear glass windows set into steel sash and curtained, provide ample and well regulated light.

Here the company owns about four acres of land with a 600-foot frontage in Amory Street, and extending in the rear 600 feet along the main division of the N. Y., N. H. & H. R. R. Company.

In 1875 the only extended use of electricity was in telegraphing, in operating door bells, burglar alarms, simple annunciators, and the ignition of illuminating gas. To its line of bells, alarms and annunciators the Holtzer-Cabot Company added electric gaslighters, magneto ringers, telephones, intercommunicating systems, time clocks, etc., and later the building of motors was launched, and in 1921 the signal department was created, which included systems for hospital signaling, fire alarms and factory calling devices.

As early as 1891, the company built for Fiske Warren, of Boston, an electric carriage, driven by motors and storage batteries, with a seating capacity of two persons, and in 1893, a second vehicle for the same owner, weighing 5,100 pounds, which seated eight persons and had a capacity of sixteen miles an hour on the level. So far as known to the officials of the company, these were the first electric carriages ever built.

In 1878 a dynamo, designed by William Stanley, who was destined to found the Stanley Works of the General Electric Company in Pittsfield, was built by the Holtzer-Cabot Company and was successfully used by E. S. Ritchie & Sons of Brookline, for charging compass needles, yet it was not until between 1890-1895 that the company began to engage seriously in the manufacture of electric motors and generators. During that period lines of direct current motors up to thirty-horse-power, generators on corresponding frames, electroplating dynamos, fan motors, etc., were designed, and although the days of the motor-driven adding machine, vacuum cleaner and washing machine were yet to come, a few sizes of small single-phase alternating current motors were finding a receptive market. Even in these early days there was some use of motor-generators, required to convert the available power or light current to current of other sorts, to charge batteries, ring bells and for other purposes.

The company early became interested in an attractive outlet for its products in the Army and Navy departments of the United States Government, and a large amount of Holtzer-Cabot apparatus has been installed in the fortifications of the War Department; on the ships of the Navy, on the submarines and in airplanes. In 1906 when President

Roosevelt sent the battleship fleet on its memorable cruise around the world, it was equipped with Holtzer-Cabot telephones, these being the used for the first time in directing gun fire. Since that date, substantially all the battleships of the Navy have been similarly equipped with the company's telephones. During the World War, the submarines of the United States and Allied nations were to a very large extent provided with its motor-generators for use in underwater communication and wireless motor-generators were installed on many of the naval vessels as well as on the merchant fleet, used in transporting troops and supplies abroad. In 1912 a Holtzer-Cabot specially constructed generator was installed on an aeroplane by the War Department and wireless communication between the plane and the earth was for the first time successfully accomplished.

In 1897 important changes were taking place in the field of telephone operation. The method then employed of signaling the exchange and the subscriber by means of a hand-operated magneto was giving way to the central energy system. There came naturally a demand for charging apparatus and it was found convenient to be able to charge batteries at the same time drawing therefrom current for actuating the receivers. It was not possible to use commercial generators for this purpose on account of the noise thus introduced into the talking circuits. The Holtzer-Cabot Electric Company at that time designed a line of special noiseless telephone charging generators of special construction for charging the batteries while the latter were still connected to the switchboard and upon occasion to disconnect the batteries and supply the board direct from the generators, which proved to be a notable engineering achievement. These machines are today installed not only throughout the United States, but in England, Europe, Australia, South America and in many other places and are still being built for this purpose.

Coincident with this was the development by the company of central energy ringing units producing alternating current for ringing bells, for selective ringing on party lines and for supplying the various special signals, such as, "the busy," "don't answer," and also the automatic ringers which when turned on signal periodically until such times as they are cut off, thus, greatly increasing the capacity of the operators in handling calls.

At present the product of the motor department is confined largely to small motors in the fractional horse-power sizes. These are usually in special forms for adaptation to automatic machines, such as musical instruments, office and domestic appliances, farm and dairy machinery, medical appliances, small elevating devices, coffee mills, meat choppers, fans and blowers, small machine tools, etc.

The products of the company are marketed almost exclusively through branch offices, under the management of its own executives, the actual selling being done by trained electrical engineers in its employ. The oldest branch office is at 6161 South State Street, Chicago, which was established in 1899 and is housed in a building owned by the company and equipped with offices, warehouse and repair shops. This branch handles all of the company's products, throughout thirteen western states. Branch offices are also maintained in New York City, and Philadelphia, where all lines are handled. There are additional branch offices handling

the signal lines in Minneapolis, Detroit, Baltimore, Pittsburgh, Cleveland and Kansas City, Mo.

Mr. Holtzer's attitude toward his employees was most fair and he early organized a shop committee, and never experienced any labor difficulties. In addition to compensation insurance, provided by the company, the employers and management established before the close of the last century, a mutual benefit association and a savings club.

In 1929 the Holtzer-Cabot Electric Company was acquired by the Gamewell Company, of Newton, but it is operated as a distinct manufacturing unit, and with its own personnel. Upwards of 600 employees are carried on the payroll.

The corporation has capital of \$1,200,000. Matthew Porosky is president, William E. Haseltine vice president, treasurer and clerk, Woodson W. Baldwin, assistant treasurer and Frank A. Schirmer, chairman of the board of directors.

THE JOHN T. ROBINSON COMPANY

When the late John T. Robinson began the manufacture of paper box machinery in Boston, in 1874, probably there were not more than fifty factories in the United States producing paper boxes, and in most of the number operations were carried on by hand, while such shops as had machinery were equipped with primitive and crude devices.

Mr. Robinson immediately directed all of his time to the development of machinery for the making of paper boxes, and ere long the price of these commodities fell as the result of his inventions, and a consequent increased demand for paper containers began at once. In the fifty-six years since he started operations there have come into being 2,800 paper box making firms, this figure not including concerns making shipping containers and other paste board products of similar type to the ordinary paper box.

Mr. Robinson has been truthfully called the founder of the paper box industry of this country, and from the day when he delivered his first machine, which is still being operated daily in a factory near Boston, to the present, the policy of the company bearing his name has been to design and produce the most efficient high-grade machinery for paper box manufacture in the United States.

For many years the Robinson machines have constituted the standards by which other equipment has been judged.

In 1904, just prior to the death of the founder, the John T. Robinson Company was incorporated, with capital of \$65,000, which has since been increased to \$300,000. Since the date of incorporation, John T. Robinson, Jr., son of the founder, has been president and manager of the enterprise.

Today, the company's products include practically every machine used in the box industry, and they are used in every country where this type of production is carried on. The concern utilizes an acre of floor space in its Hyde Park plant, employs upwards of 100 operatives, many of whom have been on the payroll for long periods of time, and the concern has had no labor troubles since its inception.

From 1897 to 1904, the company was engaged in the manufacture of automobiles, being one of the pioneers in the industry, and during these

years, thirty-five cars were built on order, at a cost of approximately \$5,000 each.

Largely due to the death of John T. Robinson, and in part to the fact that at that period it was difficult to obtain proper financing of automobile construction, because of the general distrust on the part of bankers of the future of the industry, the automobile department was discontinued.

The first license to operate a motor car in Massachusetts was issued to John T. Robinson, Jr., by the City of Boston, and gave him the privilege of motoring through the park system of the Hub. This license was granted approximately two years before the Commonwealth of Massachusetts began the issuance of licenses to operate automobiles, and when that arrangement went into effect he was given license number four.

In fifty-six years the Robinson paper box machines have done their part to bring to the attention of the world the high-grade work which Massachusetts inventors and mechanics are capable of producing.

Sales agencies are maintained in Chicago, New York, Philadelphia, Toronto, and London.

George E. Gooding is vice president, Frederick B. Hodgdon, secretary, and Charles E. Stanwood, treasurer.

THE CROSBY STEAM GAGE AND VALVE COMPANY

The Crosby Steam Gage & Valve Company was founded in 1874 by George H. Crosby, Joshua H. Millett, and associates, to manufacture valves and gages, under patents issued to George H. Crosby, and the following year was incorporated. The present officers are Carl F. Woods, president and treasurer; George F. Felker, vice president and sales manager, and Robert J. Holmes, clerk.

The original capital of \$30,000 was increased in 1881 to \$100,000 and in 1906, to \$500,000.

The company began manufacturing in a small shop in Cambridgeport, but soon afterward moved to the corner of Milk and Batterymarch streets, Boston, and in 1880 it removed its plant and offices to 93 Oliver Street, Boston. Eight years later its factory in Charlestown, was erected, which was materially enlarged in 1894. Additional buildings from time to time as the demands required have been built.

Beginning with a store and general office in Boston, the European demand for its products inspired the opening of a London office in 1884, and another in Hamburg, Germany, in 1888.

In 1914 a British corporation was organized under the name of the Crosby Valve & Engineering Company, to sell the products throughout Europe and the British Dominions in the Eastern Hemisphere.

The domestic business of the parent company increased rapidly and a store was opened in Chicago in 1889, another in New York, in 1890, and one in San Francisco in 1919. In addition to these offices it now has direct representatives in a large number of cities throughout the United States, Mexico, Central America and South America.

Following the original Crosby patents relating to safety valves, pressure gages and auxiliary devices, many patents for new inventions of Mr. Crosby and others connected with the company were issued, which were the means of establishing and maintaining its position as manufacturers of standard engineering appliances of the highest grade and

merit. This fact has been recognized at various exhibitions, the company having been awarded a first prize and medals at Philadelphia in 1876, at Paris in 1889, at Chicago in 1892, and at St. Louis in 1904, as well as elsewhere. Its products have been adopted as standard by various governments and technical schools and the largest industrial corporations, and are in general use throughout the world.

During the past ten years, extensive engineering and development work has been carried on by the company along the line of valves for high pressures and temperatures and thousands of these products are in use by the largest oil companies, central stations and general consumers of steam power. The pressure gages manufactured by the company have also been conspicuous for advanced design features, having always maintained an excellent reputation for accuracy and durability and are in widespread use throughout the largest industrial plants in the world.

The corporation has capital of \$500,000 and employs 300 operatives, and its Boston headquarters and salesrooms are at 38 Central Street.

THE GREATEST INVENTION OF THE NINETEENTH CENTURY—THE TELEPHONE

At the end of the third quarter of the nineteenth century American civilization and progress were taking on new forms. The republic had but recently emerged from the after-effects of the greatest internecine strife of all time, and national development was the order of the day.

Machinery was beginning to supersede hand work. One man in a factory was doing the work of fifty at the weaver's loom, and at the cobbler's bench.

Railways were edging the stage-coach and the buggy off the highways.

The telegraph and the cable were realities and had brought the people within reach of each other, even if communication was carried on in a deaf and dumb language.

The hour had struck for the telephone to furnish the power of hearing. It was the keystone of the industrial arch.

In point of service to the people of all lands probably no invention of modern times exercised so potent an influence upon civilization as that of the telephone. It is doubtful whether any device came into practical service and wider use so speedily as this public utility, and, of course, the reason was that it speaks all languages and talks on all subjects, transmitting the classic lore of the erudite as well as the peculiar dialect of the illiterate, with equal facility. The idle prattle of the babe, the sage council of the aged, the cry of the distressed and the cheers of the victorious—all these, and more are hurled along its wires.

It remained for a Massachusetts educator, a professor who had mastered the science of the voice, and a student whose research activities had been directed along the line of vocal apparatus, to confound other experimenters who had approached the art of telephony in the light of applied electricity. As a professor of elocution or vocal physiology, Alexander Graham Bell had closely investigated the mechanism of the voice and the philosophy of sound. To him the sound box in the human voice suggested the possibility of creating apparatus which might emit vibrations not upon the errant air, but upon a transmitter which might convey articulate sounds in definite directions and at long distances.

Bell frankly confessed in after years that it was his command of the science of the voice that enabled him to produce his great invention. "Had I known more about electricity," he said, "and less about sound, I should never have invented the telephone."

Only Bell knew what transpired between the days when he toiled as a modest and obscure teacher until he emerged as the master of the world's greatest public utility. He was not without some knowledge of electrical phenomena, however, as, in the years before he became a teacher of vocal physiology, he had studied and experimented with this mysterious force.

But the basic idea of the telephone did not involve so much the science of electricity as it did the physical mechanism of the human voice, and of sound.

There does not exist the shadow of a doubt that if, in 1874, when Bell began to work on his major invention, he had approached any competent electrician of that era he would have been informed that he was attempting the impossible.

There had been telephones before Bell's, but they were not of the electric type. Long before his day, the youth of all lands had improvised the "Lover's Telegraph"—that crude combination of empty tin cans and tightly-stretched twine. "Sound" telephones, "steam" telephones, and "musical" telephones existed half a century before the Centennial year.

Philipp Reis, the German scientist, had transmitted musical notes—intermittent sounds of various kinds over an electric current—a number of years before, and had denominated the instrument a "telephone."

But up to 1876 the differentiation between *sound* and *speech* had not been applied to a wire test.

THE DISCOVERY OF A NEW ART—SPEECH TELEPHONY

Everybody who knew anything about electricity at the time bore home on Bell the perfectly obvious fact that it was manifestly impossible to send the continuous vibration of the human voice, with its inflections and overtones, via a make-and-break current. Dots and dashes, to be sure, they said,—but not the voice.

Bell agreed with them, thus indicating that he was schooled in the fundamentals of electricity, but he petulantly replied that he had never intended to employ a make-and-break current, and that he would demonstrate the possibility of making a continuous current of electricity vibrate with the tones of the voice precisely as the air vibrates with the speaking voice—a mere substitution of electrical waves for the air or ether waves that carry the words of our every-day conversations.

When he asserted that persons miles apart could speak to each other along an electrified line, his auditors looked askance at each other, pointed to their foreheads, shook their heads dubiously, and assumed expressions of pity for this man whom they believed was mentally unbalanced.

In this day of the home made radio, when purloining speech out of the air constitutes the most popular form of indoor sports, it is next to impossible to understand how the public of less than sixty years ago was so eager to discredit Bell's invention of the telephone.

To the denizens of the seventies, it was the product of the mind of a madman, and even after he had demonstrated the invention, he was not believed.

It is significant that nobody before him, and nobody since, has been able to discover any means other than those employed by Bell to accomplish the same result. Had he doubted the possibility of his conception, probably he would have abandoned his experiments. But with the faith that was in him he overcame the opposition that attended his efforts, the ill health that was aggravated by his night and day application to its development, and the poverty that attended him until long after it was an actuality.

Of far greater importance than the mere invention of a new handmaiden of service to mankind, Bell's telephone represented the discovery of a new art—that of speech telephony.

To understand his devotion to this art one needs to delve into his ancestry. He was the third in direct descent to become an expert in the field of speech, and in a sense it may truthfully be said that he inherited the telephone.

His grandfather, Alexander Bell, was a recognized authority, in Scotland, on pure diction, a teacher of speech, and the author of a text book on elocution, and, on the authority of the inventor, "was the strongest single influence in shaping his career."

Alexander Melville Bell, son of Alexander Bell, and the father of the inventor, followed the family bent, organized a class in Shakespeare, corrected faults of speech, directed amateur theatricals, became his father's professional assistant, and was described in the Edinburgh city directory, at about the time of the birth of his second son, on March 3, 1847, who was none other than Alexander Graham Bell, as a "Professor of Elocution and the Art of Speech." Later, the father announced his famous system of alphabetics, known as "visible speech," around which George Bernard Shaw, in later years, was to build his comedy, "Pygmalion."

Originally christened plain "Alexander," the young son's admiration for Alexander Graham, a frequent visitor at the Bell home, led him to adopt the name, "Graham," chiefly because he liked it—a circumstance typical of his characteristic independence.

From his musically inclined mother, young Bell inherited the acute ear which was destined in after years to pick up the faint "ping" of a wire accidentally plucked in a Boston attic, and to instantly recognize in that fleeting sound the principle of the electric transmission of speech.

In the late sixties Bell was loaned a copy, in the German text, of Helmholtz' work "On the Sensations of Tone as a Physiological Basis for the Theory of Music," and being unable to read the book he made out just enough from the plates, or at least thought he did, to confuse the oral description, and to cause him to reach the conclusion that Helmholtz had sent vowel sounds by telegraph. He argued to himself that if Helmholtz had accomplished this, why not consonants, and speech? Of course, the German scientist had done nothing of the kind, but Bell did not discover his error until two or three years later.

In experimenting with tuning forks and electro-magnets, trying to reproduce an effect which he mistakenly believed was well-known, Bell had his first actual experience with electricity, and he felt that he must duplicate Helmholtz' results.

Just before he left Great Britain in 1870, Bell realized his mistake, but the idea had firmly intrenched itself in his mind. "I thought that Helmholtz had done it," Bell said in after years, "and that any failure was

due only to my ignorance of electricity. It was a very valuable blunder. It gave me confidence. If I had been able to read German in those days, I might never have commenced my experiments."

THE INVENTOR IS GIVEN A YEAR TO LIVE

Events transpired with startling suddenness which altered the entire trend of his life, and which gave Massachusetts, rather than the British Isles, the inventor of the telephone. Alexander Graham Bell's young brother died of pulmonary tuberculosis, in 1867. Three years later his oldest brother was threatened with the same disease, and just as he seemed out of danger, he died suddenly. The grief-stricken parents became aware of the pallor and frequent exhaustion of the only son left, and, at fifty-one, Alexander Melville Bell abandoned his London career, and left with his wife and surviving son for Ontario, where the family settled in the town of Brantford—the place that Alexander Graham Bell—in after years, said was where he was expected to die.

He was fond of repeating the statement that the London specialist whom he had consulted had given him from six months to a year to live. However, the Canadian climate seemed to agree with him, and when his father returned from filling some long-standing lecture engagements in Boston, and was invited to give another series there on visible speech, he pleaded teaching engagements in Canada, and suggested that when his health was fully returned, his son should be invited in his stead.

Through the efforts of the School of the Deaf—later the Horace Mann School—Alexander Graham Bell came to Boston, in April, 1871, to deliver his lectures, later repeating them in Northampton, at what is now the Clarke School, and, the following year teaching at the Asylum for Deaf Mutes, in Hartford, and at Newton Upper Falls.

BELL MEETS MESSRS. SANDERS AND HUBBARD

In the fall of 1872, the principal of the Boston School, Miss Sarah Fuller, who had given a few weeks' instruction to a five-years-old boy, the son of Thomas Sanders, of Haverhill, introduced Bell to the father, and it was arranged that Bell should undertake the education of the child.

Subsequent events show the vital influence of this fortuitous meeting in giving the telephone to a waiting world, because without the financial assistance of Thomas Sanders, which was extended almost to the point of impoverishing the donor, Bell would have been obliged to look elsewhere for his living expenses until the invention had become a commercial actuality.

Soon after meeting Sanders, there also came to Bell's help, Gardiner Greene Hubbard, then a prominent Boston attorney, whose daughter, Mabel, had lost her hearing as the result of an attack of scarlet fever, from which she suffered at the age of four-and-a-half-years. Hubbard had long been interested in the oral teaching of deaf children, but it was displayed at a period when indifference was manifested by public servants, and his crusade for state appropriations for this class of unfortunates appeared to be in vain.

Hubbard was the grandson and namesake of Gardiner Greene, who at one time was regarded as Boston's wealthiest citizen. He had been instrumental in bringing to the Hub and to Cambridge the first street railway outside of New York City, and he was one of the promoters and incor-

porators of the Cambridge Gas Light Company and also interested in local manufacturing and mercantile enterprises. His sympathies were legion, and his enthusiasm boundless. While oftentimes his judgment did not appear to be justified, always his efforts were directed towards progress.

Today, he would be classed as a promoter, and it was as such that he played an important role in the evolution of the telephone.

Naturally, Gardiner G. Hubbard consulted Bell about his daughter, who had become adept in lip reading, and the claim has been made that Mabel Hubbard was at one time a pupil of the inventor, but this seems to have been fiction. It was as a lover that Alexander Graham Bell—brilliant, ardent, and poor—was attracted to the young, beautiful and wealthy woman. Naturally, they encountered parental displeasure and discouragement even bordering on ridicule of the young man's genius. Their later love affair profoundly influenced the development of Bell's epochal invention, but the telephone was not the direct result of his efforts to give hearing, or a substitute for hearing, to Mabel Hubbard, as some writers have asserted.

According to the account of the inventor, his first experiments to "devise an apparatus that might help deaf children," were initiated because of his earlier work at the Horace Mann School, and in 1894, when the twenty-fifth anniversary of the founding of that institution was observed, Bell said in the course of his tribute to the institution: "It is only right that it should be known that the telephone is one of the products of the Horace Mann School for the Deaf, and resulted from my attempts to benefit the children of this school."

During the winter of 1872-73, Bell gave lessons in speech by day, and by night pursued a series of experiments with tuning forks, which shortly after resulted in the harmonic or multiple telegraph—the harbinger of the telephone.

Next to Bell's room, on Newton Street, Boston, lived a young man named Richards, who obligingly allowed the inventor to string a wire from Bell's domicile to his own, and who listened to the former's signals, wondering what they were all about. He recalled Bell's excitement whenever he got the effect he was seeking. So fearful was the youthful inventor that somebody would gain knowledge of his apparatus that he wound the electro-magnets, with his own hands, rather than entrust them to an electrician or a mechanic before he had secured his letters-patent on the invention.

Remaining up practically all night, and eating as infrequently as he slept, he was a physical wreck in the spring of 1873, and in May he went home to Brantford. When he returned in the fall, it was to make his home with Mrs. Sanders, the grandmother of his pupil, George Sanders, in Salem, where he remained until January, 1876.

At the outset, Bell fitted the basement, with wires, batteries and tuning forks, and established his workshop there. Ultimately, the kind-hearted and interested Mrs. Sanders turned over to him the entire third floor of the large house, and Bell installed more wires which ran from there to the basement. Always late to breakfast, he frequently worked for days without leaving his upper laboratory, the meals being carried up and slipped inside the doors, on trays. The clever Mrs. Sanders realizing that this sort of life would wreck his constitution, cut the candles shorter

whenever these periods of protracted experimental work were under way, thus sending him to bed when they burned out.

Bell commuted daily to Boston for his teaching work, which he carried on in a room at 18 Beacon Street, in a building owned by Boston University, and lectured that winter at the School of Oratory conducted by that institution.

THOMAS A. WATSON ENTERS BELL'S LIFE

Early in 1874, while having some apparatus made for him at Charles Williams' shop in Boston, Bell met for the first time the young electrician who was destined to be his future assistant and co-worker in developing the telephone—Thomas A. Watson. The latter had fashioned the receiver and a transmitter for Bell's harmonic telegraph, described by Watson as being "a simple affair by means of which, utilizing the law of sympathetic vibration, he (Bell) expected to send six or eight Morse messages on a single wire at the same time, without interference." The apparatus according to Bell, had not been made as directed.

It must be recalled that in 1874 there were no electrical laboratories such as exist today. The chief use of electricity at that time was in connection with telegraphy and in firearms. No such thing as a university course in electrical engineering had been considered. Such primitive and meager apparatus as existed was fashioned in small shops of the type of Williams'.

Watson was then twenty years of age, seven years younger than Bell, and the latter exerted a great impression on the artisan. "No finer influence than Graham Bell ever came into my life," he wrote in after years; but there was a mutuality of responsibility between the two. If Watson owed much to Bell, it is equally true the latter owed much to his collaborator. Bell was almost helpless in doing anything with his hands, and Watson gave more than his services as a skilled mechanic to the invention of the telephone.

Possessed of quick intelligence, great imaginative powers, an abundance of enthusiasm, an unswerving loyalty, the keenest sympathy, and untiring zeal, he was a mentor and a constructive force for the temperamental Bell in an auspicious period of the latter's life.

BELL EXPERIMENTS WITH THE HUMAN EAR

Experimenting without success with the manometric capsule, invented by Koenig, and with Leon Scott's phonautograph, as perfected by Mr. Morey, a student at the Massachusetts Institute of Technology, Bell sought Dr. Clarence J. Blake, afterward famous among American otologists, for the purpose of having a phonautograph modeled after the human ear, and securing two from the Harvard Medical School, he kept one and gave the other to Bell. For nearly a year the two men remained in touch with each other, and exchanged notes covering their respective experiments—a circumstance that was fortunate for the inventor in the prolonged litigation that followed the patenting of his telephone.

Bell carried the ear to his father's home in Brantford during the vacation season, where he diligently continued his experiments. Attaching a small piece of hay to the ear as a substitute for the bristle of the phonautograph, Bell observed the vibration of the hay when he spoke into the membrane of the ear. Next he so arranged a piece of smoked glass as to

cause it to move by an attached weight, and began to study the tracings of the vibrations characteristic of the various elements of speech. Shouting vowels, all on the same pitch, and then at different pitches—e, a, ah, he watched the tracings on the smoked glass. Let Bell tell in his own words the story of how he originated the telephone:

“Each of the vowels under these circumstances was characterized by a different form of vibration, but what did that different form signify? It was the equivalent of what we call the quality of the voice.

“Now it so happened, that while I was experimenting with this human ear, I was at work on a very different problem. I was at work on a problem of transmitting musical sounds by a telegraphic instrument, by an intermittent current of electricity, and I had dreams *that we might transmit the quality of a sound if we could find in the electrical current any undulations of form like these undulations we observe in the air.*

“I had gradually come to the conclusion that it would be possible to transmit sounds of any sort if we could only occasion a variation in the intensity of the current exactly like that occurring in the density of the air while a given sound is made.

“If you were to take a phonograph tracing of, we will say the vowel ah, you would have a vibration of a certain shape. If you could get an electrical current in which that would cause variations, you would get a current that would transmit the whole ah.

“I had reached this idea and had gone a step further. I had obtained the idea that theoretically you might, by magneto electricity, create such a current. If you could only take a piece of steel, a good chunk of magnetized steel, and vibrate it in front of the pole of an electro-magnet, you would get the kind of current we wanted * * * it struck me that the bones of the human ear were very massive, indeed, as compared with the delicate thin membrane that operated them, and the thought occurred that if a membrane so delicate could move bones relatively so massive, why should not a thicker and stouter piece of membrane move my piece of steel. And the telephone was conceived.”

That recital, written by Alexander Graham Bell, in 1916, forty years after the telephone was born, is characteristic of its history, as he was accustomed to rehearse it.

The inventor added: “The conception of the telephone took place during that summer visit to my father’s residence in Brantford, in the summer of 1874, and the apparatus was just as it was subsequently made, a one-membrane telephone on either end.”

HE CONFINES HIS SUCCESS TO SANDERS

Returning to Haverhill in the fall, Bell told Thomas Sanders that he had evolved a plan to transmit speech over an electrical wire. Sanders’ enthusiasm was so intense that he offered to back the young man further in order that he might finish his multiple telegraph.

A short time later Bell visited the Hubbards, in their Cambridge home, and while in the midst of playing a sonata on the piano, he stopped suddenly, and dramatically said to Mr. Hubbard: “Do you know that if I depress the pedal and sing a note into this piano, that the piano will respond with the same note? That is if I sing ‘do,’ the piano will return, ‘do’?”

Mr. Hubbard expressed surprise, but politely inquired further, wherefore Bell explained his theory of the harmonic on multiple telegraph. The incident resulted in an offer from Hubbard to share the expenses of the Bell experiments, to which arrangement Sanders reluctantly consented in order to please the youthful inventor.

In after years Bell learned that his backers did not understand, as he did, that the telephone was included in the inventions covered by their agreement of 1874, "which might account," he said, "for the little encouragement I received to spend time on experiments relating to it. Even as late as 1876, when the telephone was an assured success, Mr. Hubbard generously offered to relinquish to me all right and title to that invention, as he was inclined to think it was outside our original agreement."

Bell also called on Dr. Blake that same fall to tell him of what had transpired at Brantford. A pad of prescription blanks lay on the physician's desk, and as the two drew pencilled tracings to illustrate the results of their respective experiments, and compared notes, Blake fastened them together with a clip, and stuck them in a pigeon hole, from which compartment they were to dramatically appear years later, just when Bell began to despair of finding documentary proof of his experiments of 1874, and at the time litigation threatened to rob him of his invention.

BELL TRANSFERS HIS EXPERIMENTS TO 77 KILBY STREET

In November, of that year, Dr. Blake's father offered Bell the use of a room in the building owned by him at 77 Kilby Street, and during that winter this location and the loft of Williams' shop, at 109 Court Street, saw more of the inventor than did Mrs. Sanders' Salem basement. It was in this attic room over the Williams shop, divided by a partition, and lighted by two peaked and fly-specked windows, that Bell and Watson were to make the initial tests of the first telephone, to the accompaniment of whining belts and lathes below.

Watson also lived in Salem, and commuted with Bell. On Sundays they would enjoy long walks, when the inventor would unfold to his eager and mentally hungry junior his mechanical and scientific ideas, among which was Bell's firm belief in heavier-than-air flights. "From my earliest association with Bell," Watson wrote, "he discussed with me the possibility of making a machine that would fly like a bird. He took every opportunity that presented itself to study birds, living or dead * * * One Sunday we found a dead sea gull on the beach at Swampscott. Bell spread it out on the sand, measured its wings, estimated its weight, admired its lines and muscle mechanism, and became so absorbed in his examination that, fastidious as he always was, he did not seem to notice that the specimen had been dead some time. As I was less enthusiastic, I was obliged to keep well to the windward of the bird during the discussion."

The talk veered to a light steam engine and boiler that Watson had built, and Bell expressed the thought that if it could be made larger it might provide power for a flying machine. "I fancy," Watson added, "if Bell had been in easy financial circumstances he might have dropped his telegraph experiments and gone into flying machines at that time."

It was in the summer of 1874 that Bell learned that Elisha Gray, of Chicago, then in middle life, and the chief electrician of the Western Electric Company was also at work upon a device for sending a number of messages simultaneously by telegraph, and it had been reported to him

that it was extraordinarily like his own apparatus. In an agony of distrust, he spread his purchases of supplies over the widest possible area, buying only one commodity from a given dealer lest some rival should duplicate the order if he bought at one place exclusively, and refusing admission to anybody to enter his workshop, in Salem.

By February of 1875 the multiple telegraph was close enough to success to apply for a patent, and Bell left for Washington to draft the specifications and to file his application, Mr. Hubbard arranging that the inventor should stay at his lodgings there to save expenses, and Mr. Sanders advancing the money for his railroad fares.

While in Washington he demonstrated his invention, with some hastily assembled and crude apparatus, to President Orton, of the Western Union Telegraph Company who invited him to New York to carry on further experiments. These went well, but the need of many adjustments and improvements was obvious, and to add to Bell's troubles, he was informed that his application for a patent was declared to interfere with one filed by Elisha Gray.

"By spring," Watson wrote, "my faith in the harmonic telegraph had vanished, and at last, after months of work on it, Bell's magnificent courage began to flag."

In April of that year, Elisha Gray's attorney, Mr. Hayes, proposed that Bell should merge his work with Gray's, and when the proposition was advanced to him by Mr. Hubbard he wrote, with some degree of asperity: "I don't propose to have Mr. Hayes enter my sanctum sanctorum," but he did agree he would run a wire downstairs from his laboratory, "into one of the parlors."

Watson has emphasized the good fortune that was concealed in the failure of the multiple telegraph to realize its full potentialities. "Had it been a complete success Bell might never have persisted to its greater sequel," writes Catherine Mackenzie, his biographer.

On May 24, 1875, Bell wrote his parents that the patents that had been granted him without opposition were:

1—The principle of converting a vibratory motion into a permanent make or break of a local circuit;

2—The special form of "vibratory circuit breaker" put in illustration;

3—The autograph telegraph, which he said was fast approaching completion; and which would transmit 3,000 letters per minute as against 300 by Bakewell's autograph telegraph.

He added, "Every moment of my time is devoted to the study of electricity and to experiments. The subject broadens. I think that the transmission of the human voice is much more nearly at hand than I supposed."

How prophetic! The transmission of the human voice was not only more nearly at hand than he had anticipated, but actually it was only one short week away, for on the second of June, quite by accident, and only for the fraction of a second, the clue to speech over a wire flashed into the noise and summer heat of that dirty attic above Williams' machine shop.

It was the "means" for which Bell had patiently waited a year, to accomplish his conception of 1874. Doubtless it was an effect that had been produced countless times in the operation of telegraphy—produced accidentally, as it was on that June day in the Boston attic.

But "only an ear as highly trained in sound as Bell's, only a brain as alert to its meaning as his could have caught that split-second flash and recognized it for what it was." It was afterwards that, according to Watson, "Moses G. Farmer told me with tears in his eyes that when he first read a description of Bell's telephone he couldn't sleep for a week, he was so mad with himself for not discovering the thing years before." "Watson," he added, "that thing has flaunted itself in my very face a dozen times within the last ten years, and every time I was too blind to see it. But if Bell had known anything about electricity, he would never have invented the telephone."

Bell's harmonic telegraph operated by means of signals of different musical pitch. It was necessary to accurately tune the receiving apparatus to the transmitter, and when the pitch of the receiving springs varied—even ever so slightly—from those of the transmitting instrument, the signals were thrown into hopeless confusion, which probably was the reason why the apparatus did not attract the Western Union Telegraph Company. Watson's ear was unequal to the delicate adjustment required, and consequently Bell was accustomed to tune the receiving springs himself.

THE BIRTH OF THE TELEPHONE

On that famous June afternoon he was pressing the receiving springs to his ear, as he was wont to do. Sixty feet away, in the other attic room, separated by a wooden partition, Watson plucked the corresponding spring in the transmitting apparatus. Bell tuned one after another, listening intently while he manipulated the tuning screw, until suddenly one of Watson's springs ceased vibrating. He touched it again to start it, but still it stuck. Watson kept on plucking it, when suddenly he heard a shout from Bell, and as the latter strode into the room, he shouted, "What did you do then. Don't change anything! Let me see!"

Watson writes, "I showed him. It was very simple. The make-and-break points of the transmitter spring I was trying to start had become welded together, so that when I snapped the spring the circuit had remained unbroken while that strip of magnetized steel, by its vibration over the pole of the magnet, was generating that marvelous conception of Bell's—a current of electricity that varied in intensity precisely as the air was varying in density within hearing distance of that spring."

The current thus produced passed through the connecting wire to a receiver so constructed as to transform it into a faint replica of the sound, and the man at that end who heard it instantly recognized it.

"The shout I heard," writes Watson, "and his excited rush into my room were the result of that recognition. The speaking telephone was born at that moment. Bell knew perfectly well that the mechanism that could transmit all the complex vibrations of one sound could do the same for any sound, even that of speech."

For several hours thereafter, Bell and Watson verified that fortunate accident, and repeated the effect with every tuned spring on the apparatus.

"Before we parted that night," wrote Watson, "Bell gave me directions for making the first electric speaking telephone. I was to mount a small drum-head of gold-beater's skin over one of the receivers, join the center of the drum-head to the free end of the receiver spring and arrange a mouthpiece over the drum-head to talk into."

Too excited to sleep, Bell wrote to his financial angel, Mr. Hubbard,

that night: "I have accidentally made a discovery of the very greatest importance," and added that he would call upon him the next evening to give him the details. Unfortunately no record survives of that memorable conference.

Watson could scarcely await the dawn of the third of June, and he rushed the apparatus to completion before nightfall—the first telephone, transmitter and receiver in one—a great triumvirate—with its stretched membrane of gold-beater's skin. Crude as it was when compared with the telephone of today, it operated precisely as does the device of 1930, on what Watson termed "a soundshaped current" of electricity—the only means yet discovered for sending speech over a wire.

It was agreed that the attic rooms were too near together to produce an adequate test and Watson strung a wire down two flights of stairs to the main floor of the Williams shop, ending it near his own work bench. When the shop was closed, Watson hid the telephone in his clothes locker, and went to supper. Upon his return, Bell arrived, the latter going to the attic, while Watson listened at the duplicate instrument below. Bell shouted and sang, concentrating the vibrations on the membrane with his sure knowledge of voice mechanism. Placing the apparatus to his ear, to listen to Watson, he heard not the slightest sound. But a clatter on the stairs indicated that Watson was approaching. As he burst into the attic he excitedly exclaimed: "I could hear you. I could hear your voice. I could almost make out what you said."

They changed places and tried again, but Bell could hear nothing. All through the initial experiments this remained true. Watson's hearing was most acute, and he could hear Bell better than the latter could hear Watson. Bell's unusual speaking voice, which he used with the skill of training and long practice accounted for that factor.

One variation after another was suggested by Bell, and as fast as they were sketched Watson fashioned them, these experiments and tests continuing all through June.

Meantime Bell continued to write enthusiastic letters to Mr. Hubbard who was not impressed by the possibilities of this new product, and who preferred to have him complete the multiple telegraph and the autograph telegraph. Hubbard admitted later: "During the summer and autumn of 1875, Mr. Bell's mind seemed to me to be occupied with the electric transmission of speech a great deal more than was to my pecuniary advantage, as I did not then believe the transmission of speech could ever be made commercially valuable and I at several times remonstrated with him for spending so much time on the subject."

Mr. Hubbard did Bell a service that cannot be measured in dollars by advising the writing of constant letters on his work which were to prove of such enormous value to him in later years, when the priority of his invention of the telephone was in dispute, while Hubbard's assistance in connection with the commercialization of the invention fully redeemed his early apathy. However, it is quite evident in studying the events in Bell's career during 1875 and 1876 that had there been no opposition expressed to his experiments in the telephone field his invention might have been perfected and patented a full year before it was, and this despite the fact that it was the first in actuality.

To add to his troubles during the summer of 1875 everything did not move smoothly in his love affairs. At that period, Mr. Hubbard seems

to have told Bell rather bluntly that unless he gave up the nonsense of the telephone, and got down to hard work in perfecting the multiple telegraph, he could not marry his daughter, and following that phenomenal August when it rained in New England every day of the month, Bell became wretched and unstrung, and early in September he fell ill and went home to Brantford.

BELL PREPARES THE ORIGINAL SPECIFICATIONS

But he did not give up the telephone, and while at home he began the written draft of the patent specifications covering the invention, penned on glossy ruled, foolscap sheets, of the "examination paper" type. Seven of these historic pages survive.

Bell felt that he had asked Messrs. Hubbard and Sanders for about all that he could expect by way of pecuniary help, at least until some of his inventions began to bear fruit. Therefore, he decided while at Brantford to acquaint his father's neighbors with his situation. Honorable George Brown and his brother, Gordon, agreed to loan him the required funds, provided Bell would assign to them the British and other foreign patents covering the invention of the telephone. It was agreed, however, that no application for a patent in the United States should be filed before the Browns had perfected their British patents, it being represented to Bell that the English patents would be of no avail unless they were filed prior to the date of the American application.

Bell came back to Boston and awaited the receipt of the anticipated remittances from the Browns.

Hubbard and Sanders were anxious to patent the telephone, even if they were then skeptical of its commercial possibilities, but Bell would not permit them to proceed until he could again see the Browns at the Christmas season, when he would go to Canada.

On December 29, 1875, a written agreement superseded the oral arrangements of the previous September, whereby each of the Browns was to pay Bell \$25 a month while he was perfecting his inventions, but not for more than six months, nor after patents were obtained by them. George Brown agreed to go to England immediately, but he did not sail until January 25, 1876, and failed to cable when the application for the English patents was filed, as he had agreed.

In the meantime, Bell had returned to Boston, and had removed his telephone apparatus from the Williams shop to two attic rooms on Exeter Place, where he felt more privacy was assured.

THE VARIABLE RESISTANCE CLAUSE

When Hubbard demanded that the application for American patents on the telephone should be filed, Bell pleaded that he desired to amend the phraseology of his specifications. All his life he had given evidence of having an hereditary passion for exact terminology and he entertained the feeling that the validity of his patent might depend on the choice of "undulating" rather than "vibrating," in describing the simple current that carried the human voice along a wire. When Mr. Hubbard fixed a date upon which he must have the document, Bell hurried to Cambridge where his precious patent specifications rested in Mabel Hubbard's desk, and at midnight when his fiancée who had accepted his suit, on the previous November 25th, leaned over the balustrade and told him he must re-

tire, he pleaded with her that he had not found the missing clause, but was sure he could discover it ere long. A few minutes later he observed that he had omitted any reference to the experiments in variable resistance that he had carried on during the winter of 1874-75.

"It did not take me twenty minutes," he later said, "after I found where the point was, to remedy it, and put into the patent what is now known as the variable resistance clause, and that clause saved the patent. Nearly all the litigation that took place afterward was really on that clause." "That night," added Bell, with his unfailing theatrical habit, "a girl held in her hand the whole future of the telephone."

Hubbard awaited word from Brown regarding the status of the British application until three weeks had elapsed following the latter's sailing and finally ordered his Washington attorneys to proceed, and they filed the specifications on the 14th day of February, 1876.

A few hours later on the same day, Elisha Gray, of Chicago, filed a caveat in the U. S. Patent Office, covering his ideas in the transmission of speech by electricity. The story of Gray's alleged simultaneous invention of the telephone was later to become so universal as to result in the course of the years in a belief that this caveat was synonymous with a formal application for a patent, which of course it was not. As Gray later expressed it: "A caveat is a mere description of an idea that has never been reduced to practice." A specification, such as Hubbard's attorney filed on behalf of Alexander Graham Bell, is the description of a completed invention.

Had the Browns lived up to their original agreement with Bell, his application could have been filed at Washington the previous October, in which event the coincidence in the filing of Bell's patent specifications and Gray's caveat on the fourteenth of the following February, would not have played the important part it did in the protracted telephone litigation of after years.

It subsequently developed that George Brown never filed the specifications in England. He left them in his trunk during his entire stay, fearing that he would be ridiculed were he to mention the fact that he had associated with anybody who believed they could transmit speech over a wire—undoubtedly a decision that was in harmony with British public opinion, as London dismissed the telephone when it appeared as "the latest American humbug."

Four years later, Brown was assassinated in his newspaper office by a discharged printer, and he did not live to realize the colossal fortune he and his brother lost by his insincerity and stupidity, and which altered the entire history of the telephone in England. Bell never forgave Brown, and his conduct rankled in the bosom of the great inventor until his death, being one of the few injustices he had not dismissed.

HUBBARD FILES THE APPLICATION FOR THE PATENT

It was not until late in February, 1876, that Bell learned that Hubbard had taken matters into his own hands and that he caused the application for the patent to be filed. He was summoned to Washington to consult his attorneys, and on his twenty-ninth birthday—March 3, 1876—the application was allowed, and on the seventh of the same month, the patent was granted.

It is quite significant that so fully and clearly did Bell's description

cover the entire conception of the great basic principle involved in his invention, as well as the means of utilizing it, that the phraseology he had evolved by "burning the midnight oil" was to stand every test of long years of court litigation.

The enthusiastic Watson had fitted up the back room of Bell's quarters, at 5 Exeter Place, as a laboratory, and had run a wire down a small hallway to connect it with the room fronting on the street in which Bell slept for brief periods. He had returned to his owl-like habits, as is attested by Watson, who wrote: "Whenever I finished for Bell the construction of some modification of the telephone, I carried it to the new laboratory, to spend the night testing it and discussing further improvements, getting a few hours' sleep in Bell's bed toward morning."

By this time the telephone had reached the stage of the battery transmitter. While in the first magneto-electric instrument the voice had been the sole source of power, Bell had now devised an instrument based on his experiments of 1874-75, in which the voice varied the resistance of a circuit through a galvanic battery.

On the evening of March 10, three days after the patent had been granted, Watson brought to the Exeter Place laboratory the new transmitter, "in which a wire, attached to a diaphragm touched acidulated water contained in a metal cap, both included in a circuit through the battery and the receiving telephone. The depth of the wire in the acid and consequently the resistance of the circuit was varied as the voice made the diaphragm vibrate, which made the galvanic current undulate in speech form."

THE PROPHETIC WORDS—"WATSON, COME HERE, I WANT YOU"

Neither Bell nor Watson entertained the idea at that moment that they were about to use the best transmitter that had been devised. They prepared for a night of experimentation, diluted the sulphuric acid, placed it in the cup, connected the latter to the battery and to the wire running between the rooms. Watson entered Bell's bedroom and stood by the bureau with his ear to the receiving phone. In a moment, Bell's voice seemed to leap from the diaphragm, as the imperative command was heard: "Watson, come here, I want you!"

The astonished Watson dashed down the stairs into the laboratory, where he found that Bell had upset the battery acid on his clothing. In his delight over Watson's hasty appearance, in answer to his command, Bell quite forgot all about the spreading acid stains on his trousers and he ran to the other end of the wire, to hear Watson's voice coming through clearly.

They exchanged places again and again that hilarious night, and Watson jotted down in his pocket diary some of the messages they sent each other. When they exhausted such sentiments as came to their excited minds, they counted, one, two, three, four, and the joyous Bell shouted, "God save the Queen."

In May, of that year, Bell read a paper to the members of the American Academy of Arts and Sciences on "Researches in Telephony," and permitted those in attendance to listen at the telephones he had set up in the Academy Hall and in the Athenaeum Library, both rooms being in the same building. The lecture and the demonstration created a mild stir.

Due to his reluctance to exhibit his new invention at the Philadelphia Centennial, it was impossible to secure a place for its installation in the electrical section, and finally, through the influence of Mr. Hubbard, who as a member of the Massachusetts State Board of Education, was in charge of the exhibit of that bureau, the telephone and Bell's multiple telegraph were sandwiched in with the latter's visible speech charts, and placed in an obscure corner of the Massachusetts exhibit.

The equipment included two membrane telephones, a liquid transmitter and the famous Centennial iron-box receiver, all of the instruments having been hurriedly made by Watson following Bell's last-minute decision to exhibit the apparatus.

Hubbard wired Bell that the judges would reach the section containing the display made by the Massachusetts inventor on Sunday, June 25, and on the previous day he reached Philadelphia and busied himself with his wires and batteries.

The following morning, with Willie Hubbard, nephew of Gardiner G. Hubbard, Bell feverishly adjusted and readjusted the instruments awaiting the approach of the judges. His heart sank as they neared the section where his exhibit was located and as he heard their announcement that on account of the intense heat of the day the next exhibit—the one just before his own—would be the last to be considered that day.

The one chance of being given an award appeared to be lost as Bell realized that when the judges renewed their inspection on Monday he would be back in Boston conducting the annual examinations of his classes in speech, which were scheduled to commence on June 26. He was confident that without his personal demonstration of the invention the jury would be unable to visualize its import.

Then occurred one of those peculiar and interesting coincidences, which changed the entire aspect of the situation.

Among the distinguished guests at the Centennial that summer was Dom Pedro, the Emperor of Brazil, who came early and stayed late, and who was especially interested in the educational methods in vogue in the United States. Visiting all the principal colleges and schools, he had been told about the work of young Bell, while he was in Boston, in June, and had met the inventor and chatted with him at length on the problem of the education of the deaf.

While the Centennial was not open to the public on Sundays, Dom Pedro was a privileged guest and it so happened that at the moment the judges were about to conclude their labors for the day, they paused deferentially for the Emperor to precede them, and in that pregnant second Dom Pedro observed the bewhiskered Bell aglow with excitement and anxiety lest the judging of his exhibit was to be postponed.

EMPEROR DOM PEDRO SAVES THE DAY

Stepping forward, the Emperor extended his hand in greeting, and said: "How do you do, Mr. Bell, and how are the deaf mutes of Boston?" Dom Pedro chatted on and the judges waited uneasily while Bell spoke to the Emperor of his keen disappointment that the telephone apparatus was not to be inspected that day, since it was imperative that he must leave the city that night.

"Ah!" replied Dom Pedro, "then we must have a look at it now," and

seizing Bell's arm he moved toward the apparatus. Where royalty trod the way the jaded judges followed.

The group was headed by Sir William Thomson, who later became Lord Kelvin, and to whose research activities the first Atlantic cable was largely due. When that artery of communication was successfully laid in 1866 he was knighted and he served at the Centennial as the Chairman of the Committee of Awards on electrical and related exhibits.

Associated with him that day were Prof. James C. Watson, of Ann Arbor, and Professors T. Sterry Hunt and George F. Barker, while Dr. Koenig the inventor of the manometric capsule, and Elisha Gray, of Chicago, whose multiple telegraph had but a few minutes before been exhibited to the judges, were in the group. The latter's generous appreciation of Bell's achievement in the field of telephony was to be not the least significant incident of that famous Sunday. With confident mien, Bell stepped to the transmitter, while Willie Hubbard, the width of the building distant, instructed the judges in the then unfamiliar procedure of receiving speech by wire.

From the depths of his unerring memory, Bell conjured up Hamlet's soliloquy, which his grandfather had taught him to declaim when he was but fourteen years of age, and with that dramatic effect of which the proud inventor was the master, he began, "To be, or not to be, that is the question," and proceeded to the end of the passage.

At the other end of the wire, the judges and the guests took their respective turns in pressing the iron-box receiver to one ear, closing the other with a free hand, as they marveled at the phenomenon of the human voice traversing 500 feet of electrified wire. Repeating snatches of what they heard, laughing and clapping their hands, the group became even more interested when the enthusiastic Sir William Thomson abruptly announced: "I will go and talk." As he reached the other end of the building, Bell was counting "One, two, three," over the wire.

"While I was speaking," said Bell, "Sir William came up to observe what I was doing," and the inventor handed the transmitter to the chairman of the jury of awards. Professor Barker was listening at the other end, and he announced to the group standing about: "I heard the well-known accents of Sir William's voice," and added, "Sir William is now speaking." Professor Barker continued: "A moment later, I heard him say: 'Aye, there's the rub.'" Passing the receiver to the Emperor, the latter placed it to his ear, and the expression of doubt on Dom Pedro's face immediately changed to one of pleasure as he repeated the words, "To be, or not to be," that came in from the other end of the wire.

Elisha Gray then listened, and heard, "Aye, there's the rub." Turning to the audience he repeated the words, and cheers followed the announcement.

The apparatus had worked perfectly; the judges were pleased as well as astonished, and Bell's award was assured. The inventor was congratulated by the jury and by the observers, including Elisha Gray.

Singularly enough the demonstration received but scanty treatment at the hands of the newspapers, although scores of them devoted great space to detailed descriptions of other exhibits. Here was a discovery destined to affect civilization perhaps more profoundly than any other scientific or mechanical contribution of the nineteenth or any preceding century, but at the moment it was of little significance to the press.

Sir William Thomson's recommendation said, in part: "I need scarcely say I was astonished and delighted as were others, including some other judges of our group, who witnessed the experiments and verified with their own ears the electric transmission of speech. This, perhaps the greatest marvel hitherto achieved by the electric telegraph, has been obtained by appliances of quite a homespun and rudimentary character. With somewhat more advanced plans and more powerful apparatus we may confidently expect Mr. Bell will give us the means of making voice and spoken words audible through the electric wire to an ear hundreds of miles distant."

Before the judges left that Sunday, they asked Bell's permission to transfer the apparatus to the Judges' Hall, on Monday, for further tests, to which request the inventor acceded with misgivings, fearing that in removing it the connections might be disturbed. He intrusted the work to Willie Hubbard, who acquitted himself well.

Following a chat with Elisha Gray, held in Bell's room at the hotel, the inventor left for Boston that night and concluded his only visit to the Centennial. Professor Hunt wrote a most appreciative letter to Bell, following a dinner engagement with Sir William Thomson, that Sunday evening, in which Hunt said: "He (Thomson) speaks with much enthusiasm of your achievement. What yesterday he would have declared impossible, he has today seen realized, and he declares it the most wonderful thing he has seen in America. You speak of it as an embryo invention, but to him it seems already complete, and he declares that before long, friends will whisper their secrets over the electric wire. Your undulating current he declares a great and happy conception."

On the seventh and ninth of July following Bell was busily engaged in making tests preparatory to the arrival of Sir William Thomson, in Boston. On the occasion of the second experiment a wire was grounded in New York and Bell played musical numbers on a parlor organ while an operator at the New York end placed his ear to the relay and wired that he could hear "elegantly." Bell telegraphed to ask what he heard. Back came a wire, "Yankee Doodle."

THE BOSTON AND BRANTFORD EXPERIMENTS

On July 12, Thomson reached Boston and the Atlantic & Pacific Telegraph Company loaned their wires and their quarters in the Equitable Building, where conversations were exchanged between two rooms.

Later that month, Bell placed two of his membrane telephones, an iron-box receiver, and some coils of wire in his bag, and journeyed to Brantford for his summer holiday. There, early in August, to use Bell's own words, "Articulate speech was for the first time transmitted and received between places that were separated by miles of space."

Three experiments conducted that month, each confirming the triumph, were to become historic. In carrying them forward, Bell used the membrane telephone as a transmitter and the iron-box as a receiver, the apparatus not being designed to transmit and receive messages simultaneously. They went one way by telephone and the replies came back by telegraph.

Before the long distance tests were made, Bell provided a triple mouthpiece for the membrane telephone and ran a wire from the veranda of his father's house to one of the outbuildings, members of the family taking turns first at the mouthpiece and then at the receiver. Next Bell ar-

ranged with the local manager of the Dominion Telegraph Company to use the eight miles of wire between Brantford and Paris, Canada, and connecting the membrane telephone and its triple mouthpiece at the Brantford office he drove to Paris, with the iron-box receiver and an extra high-tension coil resting in his lap. He had arranged with his uncle, David Bell, who, according to the inventor, could "recite Shakespeare by the hour" to speak into the transmitter and to direct some volunteer singers. At the Paris telegraph office, Bell connected the receiver, and listened. Suddenly there came a din of "bubbling and cracking sounds," but through the tumult, Bell could hear the voices of singers and speakers in Brantford "in a faint and far-away manner."

He was operating the line on low-resistance coils, and he wired Manager Griffin on another line to substitute an electric magnet, equipped with high-resistance coils, and while this was being accomplished Bell made the same change in the receiving apparatus. Despite noises on the line, the speeches came through so distinctly that he was able to distinguish the voices. "First I heard a cough, then a voice which said—"To be, or not to be,"" wrote Bell afterward. But he was sure it was not his uncle's voice, and as he later recorded "it sounded so much like my father's that I telegraphed to Brantford to ascertain whether it could possibly be his, for I had understood that he could not be present at the time. He was present, however, and it was his voice that I had heard."

Verily, progress was being made, as the battery connecting the Brantford-Paris telegraph wire was located in Toronto, some sixty-eight miles distant from where this experiment was conducted.

Professor A. Melville Bell, the father of the inventor, announced a public reception at his home on the fourth of August. The nearest telegraph wire was strung a quarter of a mile from the residence, and ran from Brantford to Mount Pleasant. Purchasing all the stove pipe wire he could corral in the town, young Bell, hammer in hand and with a pocketful of tacks, strung the wire along wooden fences leading from the road up to the house, and grounded the connection. When all was in readiness the main line to Mount Pleasant was cut, and while the guests listened, a long-distance program was sent from Brantford to the Tutelo Heights residence.

INTENSIVE WORK AT BOSTON

The inventor returned to Boston, in September, to find that Hubbard had induced Watson to devote half of his time to the completion of the multiple telegraph and the development of the telephone. The whole attic floor of the Exeter Place was taken over and late that month Bell and Watson "began a period of intense work on the telephone," and the inventor resumed the draft of specifications for the English patent.

"We systematized the experiments," wrote Watson, "by varying each part of the telephone in turn in every possible way, while keeping the other parts constant. The parts were few—the electro-magnet and its coils, the diaphragm, and the mouthpiece, with either a battery or a permanent steel magnet to excite the electro-magnet—but the work was difficult."

In order to find the most efficient size and thickness for the diaphragm they constructed telephones with all sizes of diaphragms from one of boiler-plate iron, three feet across and an inch thick, to a minute instru-

ment incorporating the mechanism of the human ear, all of which worked, "even the real ear telephone," says Watson, "which was, however, the poorest of the lot."

Bell always considered as one of his greatest achievements the success of his diaphragm of boiler-plate iron, which was proof to him that whatever improvements were later made in the art of telephony—the use of carbon in the transmitter and hand-drawn copper wire and loading coils in the circuit—the telephone was actually his because that boiler-plate metal had talked. The diaphragm finally adopted by Bell was, as Watson asserts, of the same size and thickness as the one in vogue today.

THE FIRST RECIPROCAL TELEPHONE CONVERSATION IN THE WORLD

Convinced that at last he had perfected a device which would permit of a reciprocal conversation over a single wire, Bell appeared one day in October at the Kilby Street office of the Walworth Manufacturing Company and asked permission to use the telegraph wire which had been installed between the Boston store and the company's plant in Cambridgeport, some two miles distant.

There was no great interest displayed by the company officials in the proposed experiment, but Bell was granted permission to make the attempt, provided he did it after office hours, so as not to interrupt business.

Bell was so confident that this important test could not fail to be successful that he publicly announced it would be undertaken the evening of October 9th. He instructed Watson to write in parallel columns the messages he uttered and the responses he heard, and Bell agreed to do the same, thus permitting the skeptics and critics to compare the conversations. He was content to rest his claims for performance upon the results attained.

Watson journeyed to Cambridgeport, with his telephone, a bundle of wire, and a few tools wrapped up in a newspaper. The factory, closed for the night, was in charge of a watchman. Watson disconnected the telegraph instruments, connected and adjusted the telephone, pressed the diaphragm to his ear, and listened for Bell's voice.

"Not a sound could I hear, although I knew Bell must be shouting," wrote Watson. "I shouted into my instrument and listened again. Nothing but black dismal silence! I looked over the connection, readjusted the telephone, then listened and called again. Could it be that, although the telephone would work all right between two rooms, it would not do so under regular telegraph conditions? I knew we were using the weakest current ever used for any practical purpose and that it was also of a very high intensity, for we had talked successfully through a circuit made up of a dozen persons clasping hands—a very great resistance. Was it possible that the glass insulators that were right for the telegraph current would not hold our much more intense current to the wire? Did a little leak to the ground at every support so that none of the electric undulations from Bell's voice got across the Charles River to where I was?"

All these and many more questions flashed through Watson's mind. He recalled the "croakers" and he remembered the doubts that had been expressed to him in private and in public by those who saw in the telephone nothing but an impractical toy.

Watson was about to disconnect the telephone, re-install the telegraph

instruments, and telegraph his failure to Bell, at the Kilby Street end of the wire, when he thought that possibly there might be another telegraph relay in another part of the factory, which was connected with the wire he was using. He was aware that if such existed, the voice-generated undulations would be neutralized. Inquiring of the watchman whether there was another telegraph instrument in the building, the latter replied he did not know. All the while the employee had been an uneasy witness of Watson's frantic behavior, "watching me," as Watson later said, "as if he thought I must be crazy, shouting into a brass contraption and expecting some one over in Boston to hear me!"

But Watson was firm and asked to be shown where the wire entered the factory. Reluctantly, the watchman took his lantern and followed Watson as he traced the location of the wire through the building, which led to the door of one of the offices. Asking his guide to unlock the room, Watson saw, much to his relief, the relay apparatus he had suspected.

"I cut it out with a piece of wire across its binding posts, rushed downstairs, followed at a much slower pace by the watchman, and listened at the telephone. It was no longer dumb! More loudly and distinctly than I had ever heard it talk between two rooms, Bell's voice was vibrating from it, shouting, 'Ahoy! Ahoy! Are you there? Do you hear me? What is the matter?' I could even hear that he was getting hoarse, for he had been shouting all the time I had been hunting over the factory building. I ahoyed back and I could hear his sigh of relief as he asked me, 'Where have you been all this time?' in a tone that indicated he thought I'd been loafing."

Then began the first long-distance reciprocal conversation that had taken place in any part of the world, for it must be recalled that in the Boston and Brantford tests of the previous summer, speech had been sent but one way, and the replies had traveled by telegraph.

The parallel record of their talk was faithfully recorded by the two participants, and was later published in the Boston *Daily Advertiser*. It related chiefly to the various adjustments made as they proceeded—cutting out the battery, replacing it, and the like. Bell said to Watson: "We may congratulate ourselves upon a great success," and Watson replied: "We deserve success. Both batteries are on now."

They asked each other to repeat the words, and Bell told Watson to whisper, which he did. Bell said he could hear the whispering, but could not understand what he said. He next asked Watson the time by his watch.

When midnight came and they thought they had made a sufficient record they continued to talk excitedly, and finally Watson let the watchman listen to what Bell said at the other end of the line. Even then said Watson, "I think he felt it was some humbug," and he appeared rather happy when he let Watson out of the building, with his queer-looking contraptions tucked under his arm.

AN IRATE LANDLADY

Upon his arrival at the Exeter Place lodgings following his long walk back from Cambridgeport, he found Bell ready for one of his war-dances which he invariably staged following his successes. Since no real war-dance can be accomplished in silence it is suspected that the pair made "Whoopie," and as Watson said afterward, it "nearly resulted in a catas-

trophe, for the next morning, after a sleepless night, as I started down stairs to go to Williams' to build some more telephones, I saw our landlady waiting for me at her door with an acid expression on her face."

He could feel the impending storm in the offing, and effected urgent haste, but it was of little avail.

"I don't know what you fellows are doing up in that attic," she ejaculated, "but if you don't stop making so much noise nights and keeping my lodgers awake, you'll have to quit them rooms."

Watson assumed a conciliatory air—for he and Bell were a little behind in their rent.

While the telephone talked at this period, it did so only moderately well. "The apparatus was delicate and complicated," wrote Watson, "and it didn't talk distinctly enough for practical use. November, 1876, was one of the most discouraging periods in the development of the telephone I can remember."

Spending days in the Boston Public Library in search of some hint or suggestion for a new adjustment, he finally stumbled upon the description of a quick-acting magnet used in the Hughes printing telegraph—not unlike the same type of magnet he and Bell had used months before, but more delicately constructed.

The words "quick-acting" were enough to satisfy Watson that this was the magnet for the telephone.

THE NEW MAGNET AND THE FIRST COMMERCIAL TELEPHONE LINE

Hastening to the Williams shop he contrived the new magnet in a few hours, and to his great joy, as he afterward said: "The thing talked so much better than any other telephone we had tried up to that time, with either electro or permanent magnets, that from that moment all telephones requiring electro-magnets and batteries went into the discard."

On the last Sunday in November a trial over the wires of the Eastern Railroad Company stretching from Boston to Salem, was made with the new apparatus, Bell being at the Hub End with his colleague in the Witch City. The sixteen-mile experiment was eminently successful, and was duly exploited in the Boston press.

The following Sunday the same railroad company offered the use of its telegraph line, stretching from Boston to North Conway, N. H.—a distance of 143 miles. On the last day of January, another trial was made on a private telegraph line running from the Congress Street, Boston, offices of the Boston Rubber Shoe Company to the home of President Converse, of that concern.

Bell's Salem, New York, Providence, Boston and other lectures and demonstrations yielded a little money, and on April 4, 1877, Watson strung the first commercial telephone line, from Charles Williams' shop in Boston, to the latter's home, in Somerville, a distance of three miles, the occasion being the first of the formal openings of telephone lines.

It is indeed difficult to imagine that today such an endorsement as was given Bell's invention by Sir William Thomson, the first scientist of his era, would fail to impress eager capital seeking to exploit profitable inventions. But the struggles of Bell, Watson, Sanders, and Hubbard to put the first American company on its feet are familiar to every student of history.

Bell made an arrangement with Colonel Reynolds, of Providence, R. I.,

to establish the telephone in England, and the prospect of a trans-Atlantic trip offered him the opportunity to press his claim for the hand of Mabel Hubbard, and they were married on July 11, 1877, and sailed for England in early August, remaining abroad for eighteen months, where their first child was born.

In his demonstrations abroad, Bell found the same difficulties he and Watson had encountered in Boston, namely, of weak telephone currents so sensitive to neighboring telegraph wires that conversations were often obliterated. Interfering wires produced results comparable to the annoying static of the present radio era.

In November, 1877, Bell patented the idea of using two conductors instead of one, and by so arranging them in relation to the disturbing wires that the currents induced in one of the phone conductors was exactly equal and opposite to those induced in the other.

All through that winter he carried on his experiments, and in January, 1878, he was commanded to appear before the Queen, and to demonstrate the telephone to royalty.

The Electric Telephone Company had already begun operations in England under Bell's patents, with a list of nineteen London subscribers, and thirty in the country—headed by Windsor Castle and Osborne House, but rival companies soon appeared exploiting phones that were infringements.

In December, 1877, the American Speaking Telephone Company was formed, with \$300,000 capital, the Western Union Telegraph Company acquiring two-thirds of the stock. The concern advertised to supply "superior telephones" made by the original inventors,—Dolbear, Gray and Edison.

In the meantime, Thomas Sanders was attempting to push the Bell Associates, formed to market the Bell invention. He advanced upwards of \$100,000, imperilled his leather business, and faced financial ruin before he received a penny from the telephone in return.

Competition with the subsidiary of the Western Union was keen, and with the parent company's forty millions of capital the American Speaking Telephone Company was able to block the Bell group through its exclusive rights-of-way over housetops and along highways, and its monopolies of railroad offices, hotel lobbies, and public resorts.

BELL BECOMES DISCOURAGED

In the spring of 1878, Sanders' relatives assisted him in forming the first New England Telephone Company and in 1878, a second corporation to operate under the Bell patents outside of New England, was formed. The cables were kept hot by the officers of the original Bell Company for evidence that would bolster the suit its officials were preparing to launch against the Western Union Telegraph Company for manufacturing and selling telephones under Bell's United States patent.

Harassed with debts, sick and discouraged with the troubles that obsessed the American and English Companies, Bell sailed for Quebec, intending to spend a few weeks at his father's home, to wash his hands of all connections with the telephone, and to resume teaching.

Watson was dispatched to meet the Allan liner, and to bring the inventor to Boston in order that he might prepare his preliminary chronological statement showing the progress and developments that led to the

invention of the telephone, which he had refused to do in response to urgent cablegrams and letters from Hubbard and Sanders. On arrival in Boston, in tow of Watson, he went to the Massachusetts General Hospital for an operation, and here, on November 20, he prepared his first statement, which was filed in time to sustain the case that had been brought, and which, perhaps, saved his patent.

The almost numberless suits brought against infringers of the Bell patent, which resulted in the most protracted and far-reaching patent litigation in the history of the world, constituted convincing evidence that the patent was the most valuable single grant of rights of this kind ever issued.

At the outset the assaults made upon it were based on the grounds of prior invention, the claimants including Gray, Dolbear, Edison, Drawburgh, Valley, Meucci, Holcomb and others.

Probably no inventor ever lived who could and did show a clearer title to his invention than Alexander Graham Bell.

In every one of the more than six hundred suits brought the courts sustained Bell as the original inventor. Five actions were carried to the United States Supreme Court, and in all the decisions were in favor of Bell.

BELL EXPERIMENTS WITH SELENIUM AND PRODUCES THE RADIOPHONE

While in England, in 1878, Bell heard much about Willoughby Smith's work with selenium, and this ultimately led him to the photophone—the first wireless telephone.

When he returned to the United States, he found his friend Watson so engrossed in the development of the telephone, that Bell arranged with Sumner Tainter—another graduate of the Williams shop, to assist him in his experiments with selenium. "It is greatly to the genius and perseverance of my friend, Mr. Sumner Tainter, of Watertown, Massachusetts," Bell said in after years, "that the problem of producing and reproducing sound by the agency of light has at last been successfully solved."

He and Tainter worked together in a laboratory at 1325 L street, in Washington, D. C., in preparing selenium for their experiments. The material resembled black sealing wax, having a smooth, glossy surface, and in their films was transparent, showing ruby red against the light, and in that form it was a non-conductor of electricity. When heated to the fusing point, and allowed to cool very slowly, it assumed a dull lead-like appearance, and in this crystalline state it was a conductor of electricity, but of extremely high resistance, in fact, so high, that a narrow strip of it, an inch or two long, offered as much resistance to the passage of an electrical current as 90,000,000 miles of insulated wire.

Upwards of fifty forms of apparatus were devised and discarded by Bell and Tainter in their experimental work. They achieved satisfactory results indoors, but a beam of light could not be run from room to room like a wire, and to get out of ear-shot the receiving telephone had to be extended to another room. On February 15, 1880, Tainter took the transmitting apparatus to the top of the Franklin school building, in Washington, a little over 230 yards away from the Bell laboratory. Listening in

the workshop, Bell heard these words uttered by Tainter: "Mr. Bell, Mr. Bell, if you hear what I say, come to the window and wave your hat."

Bell rushed to an open window, and waved. That moment the photophone was born.

Later, Bell and Tainter sent musical tones from the top of the schoolhouse to the hills north of Washington, a distance of about a mile and a quarter, and the following year they abandoned the term "photophone" for the more exact "radiophone," suggested by the French physicist, M. Mercadier, but Bell always referred to it in after years as the "photophone."

Although it could be used by day or night, its operation was limited to clear skies, and it refused to work in a fog. Its principal advantage was in its secrecy, as it was impossible to tap its messages. It was adopted by the German Government for lighthouse work.

Bell offered it to the Bell Company under his agreement to give to that enterprise all inventions in telephony, but it was put away in a pigeonhole, much to the disappointment of the inventor.

While he did some work later on an automatic switchboard, he said in after years that his interest in the art of telephony lapsed with the "pigeon-holing" of the photophone.

BELL RECEIVES THE VOLTA PRIZE

In 1880 he went to Europe to receive the Volta Prize of fifty thousand francs, awarded to him by the French Government, for the invention of the electric speaking telephone, and although he was given the Legion of Honour decoration the next year, and was the recipient of scores of awards in after years, this recognition which came to him at the age of thirty-three was, in his estimation, the greatest distinction of his life. Napoleon had established the Volta Prize, and but once before had it been awarded to any person, that instance being its bestowal on Ruhmkorff for his induction coil.

With his fifty thousand francs, then the equivalent of \$10,000, Bell established his Volta Laboratory at 1221 Connecticut Avenue, Washington, D. C., where experimental work was carried on by Sumner Tainter and Chichester Bell, and here the spectrophone, designed for measuring by the ear the invisible part of the spectrum, was created.

In 1881 Bell spent many weeks in Washington in an attempt to develop apparatus which would remove the leaden bullet from the body of President Garfield, through the medium of the induction balance.

In October of that year he perfected a telephone probe, which was used only as a preliminary to an operation for the extraction of a bullet, and for this contribution to surgery he was later awarded the rare honorary degree of M.D. by the University of Heidelberg.

The work of the Volta Laboratory Association resulted in the invention of the first successful phonograph record, a triumph which, by an odd coincidence, was to do far more for the commercial success of Edison's phonograph than the latter's transmitter did for the telephone.

The associates followed their cylindrical form of record by the invention of the flat disc record—the form now in universal use.

The story of Bell's work in behalf of the deaf is an epic and would require a volume to properly record it. His later years found him the leading American patron of aeronautics.

EVEN DEATH DID NOT SILENCE HIS DETRACTORS

On August 2, 1922, he died, and even after his passing there were whispers that after all he was but one of a number of inventors of the speaking telephone.

But those who are familiar with the facts know that beyond the shadow of a doubt there never existed at any time a scintilla of evidence that in the actual discovery and completion of the device there was no one with him or before him in the electric telephone field, and that he was not only entitled to his priority claim, but also to his oft-repeated assertion that he alone conceived the basic principle upon which the momentous invention rested.

The malicious charges of fraud that were brought against him during the almost lifelong and determined effort to wrest the telephone from him, were not only barren of justification and solely inspired by venality, but to those who knew his character were in complete contradiction to every essential in it.

The one outstanding, vital and dominating element in the life of Alexander Graham Bell was his everlasting search for truth, which amounted to a passion and an obsession.

The successful outcome of thirteen law suits of national and international import that were fought by the company which bore his name; the favorable decisions rendered by the Supreme Court of the United States in five actions that were argued before the highest tribunal in the land; the successful ending of 585 out of 587 cases defended by the Bell Company—the other two being trivial actions of contract with no reference whatever to the merits of the invention—should have forever silenced public opinion on the point that Alexander Graham Bell was the inventor of the telephone.

The danger of missing the mark in his invention; the risk of being deprived of his just meed of honor for its success; the days and nights of bitter disappointments, of evidences of lack of faith, of stinging satirical comments; the dubious admission of his crude device to the Centennial Exposition, in 1876, where it was looked upon as a toy and lacking even the germ of a great utility; the refusals of capitalists to finance its manufacture and introduction; the depression following the refusal of the Western Union Telegraph Company to purchase all of Bell's patents for \$100,000; the weeks of near extinction, when, month after month the little Bell Company lived from hand to mouth, without paying salaries; the entries in Thomas A. Watson's note book, "Lent Bell 50 cents," "Lent Hubbard 50 cents"—so typical of the poverty of the promoters in the early years of the enterprise—all these and a thousand more difficulties would have been sufficient to break down the moral fibre of an ordinary soul, and then, after the invention had demonstrated its practicability and had become universally adopted, to be confronted by an invading army of contestants who questioned the legitimacy of his invention on every ground or pretext, ordinary or extraordinary, even to claiming fraud in the United States Patent Office, whose position became stronger than ever after each succeeding conflict, would have soured the sweetest disposition in the world.

And yet the aftermath ought not be overlooked. For months the Bell Associates possessed a monopoly of the telephone field, and nobody

appeared to dispute the claim. They owned the patents, but they lacked the capital necessary to translate the invention into a practical public utility.

Then occurred one of those fortuitous events whose sponsors little dreamed would react as it did. The Western Union Telegraph Company was the natural enemy of the telephone as a means of communication by wire.

It should be recalled that when Bell approached President Orton of the Western Union, with a proposition to sell his patent to that corporation for \$100,000, the latter cynically inquired, "What use could this company make of an electrical toy?" But when the officials learned that some of their instruments had been superseded by the new invention, they speedily organized the American Speaking Telegraph Company, retained Edison, Gray and Dolbear on their staff, and publicly announced that they possessed "the only original telephone." The effect of this announcement was scarcely anticipated by the officers of the Western Union Telegraph Company.

That corporation had unconsciously established the credit of the Bell Associates, and almost overnight the telephone was no longer a mere scientific toy, but a real medium of communication.

In a short time telephones were being rented at the rate of 1,000 a month, and little exchanges were being opened in a few of the cities, but with no business organization behind them.

Bell had invented the greatest boon of the century; Thomas A. Watson was busy night and day in his little shop on Court Street, Boston, constructing the first primitive telephones; Thomas Sanders, the Haverhill leather dealer, was financing the invention to his limit; Gardiner G. Hubbard, of Boston and Washington, and father-in-law of Bell, was throwing his personality and legal ability into it, but the business manager had not appeared.

On his frequent trips from the Hub to Washington, Hubbard met Theodore N. Vail on the train and at the hotel, and constantly armed with a telephone which he carried in his grip, he gradually interested Vail in the enterprise. The latter's curiosity had previously become aroused when he witnessed the demonstration of the telephone installed at the Centennial Exposition in 1876. Finally, Hubbard summoned his courage and asked Vail to accept the position of general manager of the Bell organization. He promptly accepted, convinced as he was that the invention had commercial possibilities.

THEODORE N. VAIL—A GREAT ADMINISTRATIVE GENIUS

At the age of thirty-three years, Theodore N. Vail, who as General Superintendent of the U. S. Railway Mail Service had established that agency in a position of greater usefulness than it had ever before occupied, resigned his position to enlist and equip an army for the conquest of a new world—that of telephony and to bring order out of chaos, as well as to establish an organization that would have functioning powers and at least a potential capital.

At the end of May, 1878, there were in operation outside of New England 6,335 telephones, of an average net rental of less than \$10 each per year.

The New England business was then controlled by the company

which earlier that year Sanders and some of his Boston relatives and friends, including George L. Bradley, W. G. Saltonstall, and G. Z. Silsby, had organized, and which had paid-in capital of \$50,000.

It was the vast territory outside of the six northeastern states that claimed the attention of Mr. Vail, and on the twentieth of July, 1878, he completed the reorganization of the Bell Telephone Company with a capital of \$450,000, Gardiner G. Hubbard, of Boston, being chosen president; Thomas Sanders, of Haverhill, treasurer; Alexander Graham Bell, electrician; Thomas A. Watson, superintendent, and Theodore N. Vail, general manager, the last-named to be "under the direction of the executive committee, and the *only salaried* officer for the time being."

An official announcement sent out by the company stated that the enterprise had been formed with a "large cash capital," which, as a matter of history, was to be raised by obtaining a loan of \$25,000 on \$100,000 worth of stock (one thousand shares) while an additional five hundred shares were to be sold at fifty dollars per share, thus securing \$50,000 if the plan worked out.

As a matter of record, Sanders was again the financial angel and advanced the \$25,000 while his friend, George L. Bradley, undertook to dispose of the 1,000 shares.

The new corporation was really the first Bell Telephone Company, as what had previously been known by that name was no more than an association of the owners of the Bell patents, with Hubbard in control of the stock.

Vail worked always as if he had infinite capital resources and he laid out a campaign on a large scale to start exchanges in all towns of any size. He introduced a five-year standard contract which required the local companies to build exchanges and which also confined their activities to specified areas. There were also contracts which provided for connecting two or more towns, although at the time it was often difficult for the users of the phones to hear each other across the street. But Vail never doubted the realization of his dream of interlinking wires extending from city to city and across the continent and the ocean.

Working early and late the results began to show. Local companies multiplied and the demand for telephones increased beyond the ability of the Bell Company to manufacture, and especially to pay for them. The corporation was constantly on the verge of bankruptcy, despite its seeming prosperity.

When the Western Union began to install the Edison transmitter, superior in every way to that in use by Bell, subscribers clamored for one as good as the Edison product, and the case of the Bell Company appeared desperate.

Treasurer Sanders was at his wits end to provide the money with which to meet current bills. Vail one day ordered a small list of supplies from L. G. Tillotson & Co., of 15 Dey Street, New York, and the commodities failing to come, a porter was sent for them only to be informed that the firm would gladly send them over as soon as it received the cash—something under ten dollars. It seems to be the irony of fate that the gigantic structure of the New York Telephone Company today stands on the site of the Tillotson store.

Vail's calmness during those trying days was a great asset. One day

an office associate inquired of him, "Don't you ever get discouraged?" "If I do," Vail calmly replied, "I never let anybody know it."

It was at the moment when conditions were most desperate that Francis Blake, Jr., of Weston, informed the Bell Company that he had invented a transmitter as efficient as Edison's, or better, and he agreed to let the Bell people have it in exchange for stock in the company. Probably no single piece of news was ever more welcome to a struggling corporation. The Blake transmitter was in use by the autumn of 1878 and the Bell Company found itself on a parity with the Western Union in equipment.

SETTLING WITH THE WESTERN UNION

Through its Boston affiliations, the Bell Company secured as its attorneys Chauncey Smith and James J. Storrow, both of whom not only stood at the head of their profession but they were men who had the cause of the struggling corporation much at heart.

When George Gifford, chief attorney for the Western Union, following the introduction of testimony which took nearly a year, advised his clients that unquestionably Bell was the original inventor of the telephone, and suggested that they withdraw their claims, and effect the best possible settlement, the company offered to lease the local business to the Bell Company, and take for itself the interchange, or toll business. Some of the officials of the Bell enterprise were favorable to the plan but Vail was adamant. Long distance telephony was his ideal. A committee of three from each company was appointed to arrange the terms of settlement, but months went by without an agreement, until finally the opposing forces met in New York, and the better part of a night was spent in reaching a definite decision to which both sides agreed on November 10, 1879, whereby the Western Union Company agreed that Bell was the inventor of the telephone; that his patents were valid; that it would retire from the telephone field; that the Bell Company would buy its system and would pay the Western Union a royalty of 20 per cent of its receipts from telephone rentals on royalties, and would keep out of the telegraph business, the compact to remain in operation for seventeen years.

The arrangement automatically added to the Bell System 56,000 telephones in fifty-five cities.

In the meantime, the National Bell Telephone Company had been incorporated with capital stock of \$850,000 and with William H. Forbes as its president, it being an amalgamation of the New England Telephone Company and the Bell Telephone Company. At that time Vail and his staff established themselves at 95 Milk Street, Boston. George L. Bradley was treasurer of the new company. Bell was still the electrician. Watson was general inspector, and Francis Blake, Jr., and Sanders were on the directorate. Oscar E. Madden became superintendent of agencies and there was no busier or more enthusiastic place in America than the Boston headquarters of the National Bell Telephone Company.

Its stock began to reflect the new condition. In the spring of 1879 it was selling around \$50 a share, but it soon went to \$100, and then to \$200 and on to \$300, and by September was quoted at \$350—a sevenfold increase in five months. When, in November, it became known that the

Bell and Western Union companies were to join forces, it soared to \$1,000 a share.

It requires no great stretch of the imagination to picture the happiness of the Bell stockholders or the corresponding sadness of those whom Vail and others had begged to become shareholders and who had declined.

Gardiner G. Hubbard's dreams were realized. He and his associates had become rich.

Vail's next coup was to acquire the New York Telephone Company, which he adroitly manœuvred and with its acquisition the National Bell Telephone Company, after a little more than a year of corporate existence, became the American Bell Telephone Company on March 20, 1880. Its original capital stock was fixed at \$7,350,000, with the officers the same as before.

At thirty-five years of age, Theodore N. Vail was recognized as one of the leaders of American industry, as well as a millionaire. His first act after his new-found wealth came to him was to discharge the mortgage on his father's farm in Waterloo, Iowa.

PROGRESS AND GROWTH OF LATER YEARS

Improvement upon improvement followed during the '80s and as early as 1882 Bell had been granted a round dozen patents covering signaling apparatus, circuit-closing devices, switchboards and subterranean conductors. Standardization of models came next, followed by the Boston-Providence line, and then the Boston-New York lines, which were opened on March 27, 1884. In 1885 the American Telephone & Telegraph Company came into existence and throughout that decade the work of carrying telephone wires underground was begun until by 1889 the Bell Company had 11,000 miles of underground wire in New York City alone, and by 1921, 62 per cent of all the Bell wires then in use below the ground.

The American Telephone & Telegraph Company grew more powerful, until by 1900, by an exchange of two of its shares for one of the Bell, it absorbed the latter company, and instead of being a subsidiary, became supreme. The laws of Massachusetts were not favorable to a policy of expansion, and it was because of this fact that the officials of the Bell Company reached the conclusion that the telephone world could best be served by the enlargement of the American unit. W. H. Forbes had resigned as president in 1887 and was succeeded by John Howard Stockton, who served two years, and next, by John E. Hudson, who had become general manager when Vail resigned that position in 1885. President Hudson died in October, 1900, and was temporarily succeeded by Alexander Cochrane as president pro tem, and next, by Frederick P. Fish, of Boston, the distinguished patent attorney, who reluctantly accepted the position. On May 1, 1907, Theodore N. Vail became president of the American company and immediately floated another stock issue, which yielded \$20,000,000. He revamped the manufacturing end and instituted a drastic policy of retrenchment. He found that in the twenty years that had intervened since his resignation the wires had multiplied more than thirty times, to 8,500,000 miles, nearly 50 per cent of which were underground; that the subscribers had grown to 3,000,000 and that the company was a wallowing giant, needing only to be set upon its feet.

The independent companies that were confusing the situation were

absorbed practically on their own terms and in 1907 450,000 telephones were linked to the nearest Bell lines, followed by 250,000 more the next year. Improved service followed; courtesy and efficiency on the part of employees were stressed; provision for the comfort and happiness of the working force was made by the establishment of rest rooms, restaurant service, sick benefits, old age and death payments and by the purchase of stock by employees.

In 1909 the Western Union Telegraph Company became affiliated with the American Telephone & Telegraph Company and President Vail summoned Newcomb Carlton to inaugurate a campaign of progress and reform. The former devised the night and day and cable letters, and the week-end cable in order to build up the business during the day and night hours when it was below normal, and three years after the old company was taken over by the new the pay of operatives had been increased over 50 per cent, and an additional \$16,500,000 had been divided among its employees. A pension system and a loan service were established. When, in 1913, the Department of Justice held that the association of the two companies violated the anti-trust laws and required their separation, the stock of the Western Union was disposed of and Vail resigned the presidency, being succeeded by Mr. Carlton.

In the meantime, President Vail of the American Telephone & Telegraph Company had been busy pushing the strands of Doolittle's hard-drawn copper wire towards the Golden Gate—the dream he had entertained from the time he assumed charge of the muddled affairs of the parent company, and by 1911 the Denver-New York circuit was opened. Pupin's loading coil made it possible to formally open the transcontinental line to San Francisco on January 25, 1915—a memorable date in the history of the art of telephony—with Dr. Alexander Graham Bell, in the New York office; President Wilson and members of the National Geographic Society listening in at Washington; Thomas A. Watson at the San Francisco end, and President Vail at Jekyll Island, Ga., where he was recuperating from a fall he had sustained.

The meeting of the East and the West in this way was a dramatic event, and was rendered more significant by the fact that following the use by Dr. Bell and Mr. Watson of a modern instrument a replica of the first crude telephone that the two had constructed in Boston was resorted to, with the inventor using the identical words of the sentence first transmitted over a wire by Bell to Watson in the Williams shop: "Mr. Watson, please come here. I want you." To which Watson replied: "It would take a week for me to do that now."

Then followed the erection of the wireless stations at Montauk Point and Wilmington, Delaware, and the use of wireless telephone apparatus in April, 1915, followed by the construction of towers on St. Simon's Island, on the Georgia coast, at San Diego, Mare Island, Darien, on the Isthmus of Panama, Honolulu, Paris, and at the Naval station at Arlington (Washington, D. C.) On September 29, 1915, President Vail and Chief Engineer Carty threw their voices directly without the aid of wires from New York to Hawaii, nearly 5,000 miles, the greatest triumph in intercommunication the world had ever seen.

Next came government control of the telephone companies during the period of the World War, and in June, 1919, President Vail retired as the head of the American Telephone & Telegraph Company and be-

came chairman of the board. On the 16th of April, 1920, the end of his life's journey was reached, "but the great work he created remains, never to come to an end so long as men buy and sell in the market place and social life endures."

THE JARVIS ENGINEERING COMPANY

In the Centennial year of 1876 Kingsbury M. Jarvis and Albert F. Upton founded the Jarvis Engineering Company, to commercialize the work upon which Mr. Jarvis had been engaged for years in developing more economical and efficient steam generating equipment than was commonly in use at that period.

For many years thereafter the company was actively and prominently identified with the designing and building of generating plants throughout New England and other parts of the United States, and it accomplished much pioneer work in developing boiler furnace construction for the utilization of the cheaper grades of fuel.

In 1906, Mr. Jarvis, who had managed the company's affairs for thirty years, retired from the enterprise, and sold his interests to W. Carlton Barnes, at which time the concern purchased the patent rights owned by Colonel William F. Morse, covering the Morse destructor and refuse incinerator, a branch of production that has been greatly developed in the succeeding years.

In 1912 a new department was created to construct refrigerating and ice-making plants, and was placed in charge of Edward M. Jennings.

Four years later the company built the modern plant and office it now occupies, in South Boston.

The active owners of the enterprise are W. Carlton Barnes, treasurer, and Edward M. Jennings, sales manager, and John E. Macy, secretary.

THE BOSTON BRIDGE WORKS, INC.

The Boston Bridge Works, Inc., was organized in 1876 by David H. Andrews, who was proprietor of the business until 1901, when the concern was incorporated.

The company was the pioneer steel bridge building concern of New England, and from its inception to date, has maintained its position as the largest bridge building unit of this section.

In its continuous operation over a period of a half century, it has designed and constructed more than three thousand bridges, constituting more than 50 per cent of the railroad and highway bridges of New England.

While the company has specialized in the construction of steel bridges, it also fabricates and erects structural steel for buildings of every description, having designed and erected in 1894, the steel structure for the first steel-framed building constructed in Boston—the Worthington Building on State Street. In 1895, the Tremont Building at Tremont and Beacon streets, Boston, was also constructed with structural steel framing furnished by the Boston Bridge Works, Inc.

The plant of the corporation, which has always been located at Binney and Sixth streets, in Cambridge, covers an area of four and one-half acres.

Ownership of the company has been in the Andrews family from the

beginning, and John G. Andrews, son of the founder, has carried on the business since the demise of his father, in 1921.

The officers are: John G. Andrews, president; William P. Shine, vice president; Henry V. Morgan, treasurer, and Ernest T. Peverly, secretary. The corporation has capital of \$250,000 and employs 300 hands.

FRANK W. HUNT & CO.

In 1876 Frank W. Hunt and Henry H. Proctor, then employed by Thomas E. Proctor, resigned their positions, and with Charles A. Haskell, formed the leather firm of Proctor, Hunt & Haskell to deal in sole and upper leather. Later Mr. Haskell withdrew his interest, and Messrs. Proctor and Hunt continued the business as Proctor, Hunt & Co., operating tanneries at Island Falls, Me., and Elkland, Pa., and supplying hides to the tannery of Charles P. Church, of Bridgewater, Me.

On July 1, 1896, this partnership was severed, when Mr. Proctor formed the Proctor-Ellison Company. Mr. Hunt continued as Frank W. Hunt & Co., which concern acquired the Island Falls and Bridgewater tanneries. The latter plant was burned in 1908 and the property was sold, but the Island Falls tannery continued in active operation until 1924.

In the early years old hemlock sole leather was produced in these tanneries, but the tanning was later changed to oak.

In 1913 a cut sole plant was started in the Pratt Shoe Company factory, in Natick, which continued in operation until July, 1928. During the years when the tanneries were operated the warehouse and offices were located on Lincoln Street, until the firm moved out after a fire which practically destroyed the building, in 1923. For the next five years the offices were located at 20-24 East Street and in July, 1928, the Natick sole factory and the offices were moved and consolidated on the seventh floor of the Harbor Building, Boston, where the firm manufactures soles for the shoe industry, and soles, taps, strips, etc., for the findings trade, its products being sent all over the United States and to some foreign countries.

The company employs fifty operatives, and Merrill Hunt is the sole owner.

THE H. A. JOHNSON COMPANY

A consignment of canary seeds to Dabney, Simmons & Co. received while Henry A. Johnson was serving as a clerk in the Grand Junction warehouse of the Boston & Albany Railroad Company, which resulted in his making the acquaintance of the members of the Dabney enterprise, resulted in the formation of one of Boston's most progressive corporations, the H. A. Johnson Company, established by Mr. Johnson on February 24, 1877, with capital of \$200, and which originally dealt in sugar, raisins, jams, spices, lemon oil, and kindred products.

The founder next conceived the idea of marketing raspberry jam in gaily painted kegs, and soon he added raisins, canary seeds, and staple commodities to his line, and eventually he rented a store at 86 Commercial Street, and hired a sixteen-year-old boy, at a salary of \$3 per week, who later became the head salesman. Buying a second-hand wagon and hiring a horse, Mr. Johnson became the first Boston wholesale grocer to deliver goods without charge, and to add dignity to the name of his

enterprise he carried on business as H. A. Johnson & Co., which was retained until the concern was incorporated as the H. A. Johnson Company, in 1909.

As the business developed Mr. Johnson realized that the possibilities were greater in the baking field than in the wholesale grocery line, and he began catering exclusively to bakers and in the early '80s he manufactured the first commercial pie filling ever sold in this country, and gradually extended to jams and jellies until today upwards of one hundred varieties and flavors are manufactured by the company. In 1882, the business was removed to India Street, and three years later to larger quarters, at 222 State Street. Then adjacent buildings at 224 and 226 State Street, and another on Commerce Street were added.

In 1907 a building on the opposite side of State Street was purchased and another adjoining it was leased, the two structures being equipped with machinery which provided the most up-to-date factory then in existence for manufacturing bakers' and confectioners' supplies.

Two years later the concern became a corporate body, with H. A. Johnson as president; E. C. Johnson, vice president, and F. R. Kimball, treasurer. The founder died on December 12, 1920, and his son, Edwin C., was elected president, which position he holds today.

The growth of the enterprise under his administration has been remarkable. New lines and new departments have been added until now the company supplies not only bakers and confectioners, but ice cream manufacturers, soda fountains, institutions, hotels and restaurants with practically everything they require in supplies and equipment.

For more than forty years the concern has built portable ovens, and within the past ten years erected a plant at Newburyport, to which a large addition was built in 1927, and where the Johnson, Ordway and Johnson continuous bake ovens are produced. At Van Buren, Me., a modern factory is maintained where the company's raspberry jam is manufactured, and another at Prince Edward Island, devoted exclusively to making blueberry and huckleberry pie stock.

The company occupies a six-story building at 21 Worth Street, New York City.

E. C. Johnson is president; C. L. Newton, secretary; A. L. Griffin, vice president, and F. R. Kimball, treasurer of the corporation which has capital of \$300,000 and employs upwards of 200 operatives.

THE EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON

In December, 1928, electric lighting in Boston reached its half-century anniversary, having had its inception, in December, 1878, when a six-light arc dynamo, designed by Charles F. Burch, was installed in the Continental Clothing House, at its former location, corner of Washington and Harvard streets.

In the interim the six lamps of fifty years ago have grown to 16,000,000, or their equivalent in connected load, and the original capital of \$100,000 of the Boston Edison Company, organized in 1886, now the Edison Electric Illuminating Company of Boston, is \$53,387,500, with a market value of upwards of \$150,000,000.

The gross earnings the first year were \$21,580, in 1888, they were \$121,000, and in 1927, they were approximately \$26,000,000. In 1886 the company served a part of Boston. Today, its wires are installed in



EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON
Charles Leavitt Edgar Station, Weymouth



EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON
The L Street Generating Station, Boston



EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON
Open Air Station at Walpole

forty-three cities and towns of the Commonwealth, covering an area of 700 square miles, and it has a property investment of \$130,000,000.

Since its inception it has paid upwards of \$33,000,000 in taxes to cities, towns, state and nation, and from 1886 to 1910, a period of twenty-five years, it paid its stockholders \$13,348,979 in dividends, and from 1911 to 1927, inclusive, \$58,000,000 more.

But perhaps what is most significant is the fact that Boston Edison's rate of growth has been greatest in recent years—a period during which many of those who like to emphasize our alleged delinquencies say we have been declining.

The only way to prove whether we are advancing or receding is to compare twenty-five years ago with the present. In 1902, when most of our critics assert we were waxing fat in an era of prosperity, such as has not been approached since, the gross earnings of the Edison Company were \$2,460,000, the dividend payments, \$727,300 and the number of kilowatt hours of electricity sold were 21,300,000.

Twenty years later (1922) the gross earnings of the company had risen to \$15,885,000, an average yearly increase of \$794,250; the dividend payments were \$3,241,000, or almost four and a half times those of 1902, while the kilowatt hours of electricity sold were 338,000,000, or more than fifteen and a half times as much as in 1902.

In 1927 the gross earnings were \$25,886,945, the dividend payments, \$6,000,000 and over 600,000,000 kilowatt hours of electricity were sold for power, heating and lighting purposes, an increase in five years in gross earnings of 63 per cent; in dividend payments, one of 85 per cent, and in kilowatt hours, an increase of 76 per cent.

In 1928 the gross earnings of the company reached \$27,749,658, the dividend payments made were \$6,406,500, and 747,905,513 kilowatt hours of electricity were sold. During that year the corporation generated by steam 810,533,300 kilowatt hours and purchased 77,273,437 kilowatt hours, a total of 887,806,737, leaving 139,901,224 kilowatt hours unaccounted for and lost in production, transmission and delivery.

That year the company used 510,874 net tons of coal in its plants, and served 330,183 customers. Of the company's more than 15,000 stockholders, upwards of 13,000 are residents of Massachusetts.

One of the most reliable gauges that can be evolved in attempting to discover whether Massachusetts is declining or gaining is the number of new buildings erected. The Edison Company makes a careful check-up annually of the new structures built in the forty-three towns and cities it serves, and during the five years from 1924 to 1928, inclusive, the average number built was 4,752 per year, while in 1928 there were 5,384 new structures erected in these towns and cities, an increase of 13.3 per cent over the average of the five preceding years.

During 1928 alone the company added 29,883 new customers, and that year expended approximately \$5,000,000 on additions to the switch-board unit and boiler room at the Edgar Station in Weymouth.

It is possible that there have been power developments of greater extent during the past few years than those in which the Edison Electric Illuminating Company of Boston and the New England Power Association, both Boston enterprises, have led, but if so, their story has not been told.

A reservoir of 2,800,000-horse-power, dwarfing Muscle Shoals or Boul-

der Dam by comparison, has been built up in the past ten years by five public utility systems, whose interconnecting transmission lines sweep westward from Massachusetts Bay to the Adirondack range and the Great Lakes, and these systems produced 6,600,000,000 kilowatt hours of electrical energy, in 1927, while in the following year for the first time in history the production ran above 7,000,000,000 k.w.h.

These five systems compose a homogenous unit of the nation's power industry, and, in addition to the Edison and New England Power branches, include the Mohawk-Hudson and Northeastern Power Corporations, and the Buffalo-Niagara and Eastern Power Corporation.

When the Panama Canal was under construction many Americans were appalled by the huge expenditure required in building that greatest engineering project in history, but the amount of money that has been spent in harnessing the Connecticut, Deerfield, Hudson and Mohawk rivers, and the powers of Niagara and the Adirondacks, in installing the most powerful generating machinery, in building and equipping steam stations at tidewater so that the power supply may be ample even in the driest month, and to tie these sources with one another and with the consumer, has resulted in a capital outlay of between \$500,000,000 and \$750,000,000—an amount sufficient to build three Panama Canals.

Since the building process is endless, each recurring year finds new millions of capital being poured into the coffers of these corporations.

It was but a little over twenty years ago that the pioneer project of harnessing the Connecticut at Vernon, Vt., was completed by the New England Power Association, and recently that corporation effected a 300,000-horse-power development at Fifteen Mile Falls that more than doubled its installed hydro-capacity and that furnishes 425,000,000 kilowatt hours each year for transmission at 220,000 volts—the highest transmission pressure used north of the famous Conowingo-Plymouth development.

THE STUPENDOUS DEVELOPMENTS OF THE LAST FIVE YEARS

From the beginnings of industry in the Massachusetts Bay Colony to this hour there have never been such major developments as have taken place in contemporary power history in New England within the past five years.

In northern New England, the Insull interests extended their holdings in 1928 through the acquisition by the New England Public Service Company, a subsidiary of the Middle West Utilities Company and of the Cumberland County Power and Light Company, which next to the Central Maine Power Company is the largest electric utility in Maine. The Insull organization also acquired the Utilities Power Company, the Tilton Electric Light and Power Company and the Franklin Electric Light and Power Company. Three Vermont-New Hampshire subsidiaries of the New England Public Service were tied with the New England Power Association system, namely, the Twin State Gas and Electric Company, the Vermont Hydro-Electric Corporation and the Public Service Company of New Hampshire.

This interconnection completes a transmission line pathway linking the Insull properties in the Middle West and in Northern New England.

The New England Public Service Company inaugurated construction

operations on the Kennebec River development at Bingham, where will be put to work a 40,000-horse-power block of the hydro-capacity for which Maine is famous.

A new departure in Eastern utility operation was effected during 1928 by the Connecticut Electric Service Company, which has been interconnected with the New England Power Association since the building of the Millbury-Montville line in 1919, upon the completion of its 24,000 k. w. Rocky River hydro-electric project. The essence of this novel development is that off-peak power is used to pump Housatonic River water uphill into a reservoir where it is held until load conditions place a premium on available power, when it is sent downhill again through generating machinery at the base of the penstock.

The initial operation of the world's first commercial mercury vapor generation unit of 10,000 kilowatts in the South Meadow steam station of the Hartford (Conn.) Electric Light Company occurred in September, 1928, with the result that the overall coal consumption of that station, which contains two 20,000 k. w. steam units in addition to the mercury vapor installation, was reduced from 1.5 lb. to 1.1 lb. per net kilowatt-hour delivered to the bus. The Hartford company is a member of the Connecticut Valley Power Exchange of which another member, the Turner's Falls Power and Electric Company, interconnects with New England Power.

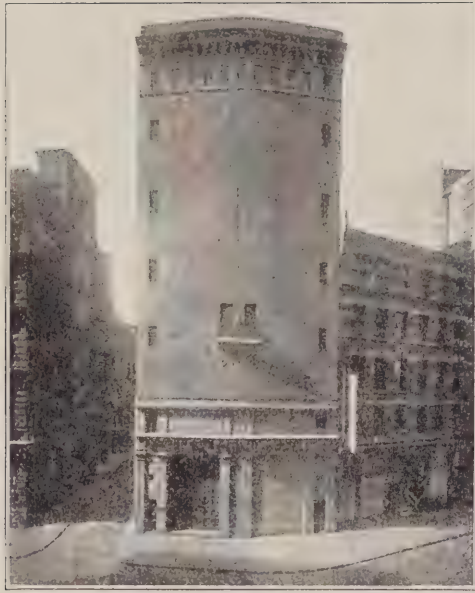
The year 1928 also witnessed the beginning of construction work on the 32,500 kilowatt English steam station, of the United Electric Illuminating Company of New Haven, and early the same year the Federal Power Commission licensed the Northern Connecticut Power Company to effect a 36,000 k. w. hydro-electric development on the Connecticut River at Windsor Locks, thereby augmenting Southern New England's power supply by 180,000,000 k.w.h. per year. Water passing through the Windsor Locks turbines will have done work at Fifteen-Mile Falls, Wilder, Bellows Falls, Vernon, and Turners Falls, on the Connecticut, and on the Deerfield River Stations from Searsburg to Shelburne Falls, and Holyoke.

THE ROMANCE OF MODERN ELECTRIC DISTRIBUTION

The inter-system operating relationships that have been developed by the Boston Edison Company and New England Power Association constitute an intricate network that emphasizes the romance in the ebb and flow of power transmitted at high pressure and with the speed of light over distances separating such points as the far Adirondacks and the coastal cities of Massachusetts and Rhode Island.

It smacks of the supernatural to think of the prospect of delivering to Massachusetts load centers hydro-electric energy manufactured on the upper reaches of the Connecticut below the Canadian line and it savors of the art of the prestidigitator when one observes that power can be exchanged between Millbury, Mass., the load dispatching center of the New England Power Association, just south of Worcester, and Watertown, Rochester, or Buffalo by using the high lines of but three systems.

By the throw of a switch the Watertown load dispatcher can pass this power along, via St. Lawrence County Utilities, Inc., to a customer on the St. Lawrence, or the Millbury load dispatcher can shunt it down to Hartford, Waterbury or South Norwalk, Conn.



EDISON ELECTRIC ILLUMINATING
COMPANY OF BOSTON
Sub Station at Arch Street



TOWERS AND AERIAL OF W. E. E. I. BROADCASTING STATION
Edison Electric Illuminating Company of Boston

The statistics of the New England power zone tell a fascinating story, and demonstrate in irrefutable fashion that whatever the "New South" may have done to place cheap water-power at the disposal of industry, the northeastern utilities have not lagged behind in their power development.

These figures establish the fact that of the 2,800,000-horsepower developed by the five zone utilities—the Edison, New England Power, Mohawk-Hudson, Northeastern and the Buffalo-Niagara and eastern units—a full half (the percentage is 50.5) is powered by white coal, representing the inexhaustible energy of our rivers and streams. A large share of the steam facilities must be reserved for peak load use, for this 50 per cent of the generating equipment actually manufactures 77 per cent of the power. Excluding the Boston Edison Company, which operates no hydro facilities, the hydro-production percentage is 87 for the zone extending laterally from Millbury, Mass., to Buffalo, N. Y. However, it is enough to say that out of every 100 kilowatt hours generated along the power pathway from Boston to Watertown and Buffalo, seventy-seven kilowatt hours are produced by the motion of water falling from source to sea. To a very large extent these sources of energy were unused until the advent of the post-war period of power development.

Statistically speaking, the manufacture of 5,126,752,000 hydro-electric k.w.h. in 1927 by the four utilities in the Boston-Buffalo zone (excluding the Boston Edison, which makes all its power by steam) entailed a coal saving of more than 4,000,000 tons. These figures will be materially increased with the completion of the projected hydro developments within the zone. The Fifteen-Mile Falls development alone will save 212,500 tons of coal per year, using the record-breaking fuel rate of 1 lb. per k.w.h. achieved by the Boston Edison Company as the yardstick.

RAMIFICATIONS OF THE STEAM AND HYDRO-ELECTRIC PLANTS

Linked by steel towers and transmission lines over which power passes under a pressure of 66,000 and 110,000 volts, one catches a glimpse of the great steam systems which extend south from Boston to Providence and Fall River, the hydro system which brings into the equation the powers of the Connecticut River and its watershed, and the steam and hydro system which ranges half way across the Empire State, tapping the developments of the famous Mohawk and Hudson watersheds and reaching into northern New York to tie the Adirondack powers with Boston and Buffalo, finally extending west to Buffalo and Niagara Falls.

The capacity of this network is 2,800,000-horse-power. Add the Rochester Central Power Corporation System, which spreads out around the transmission lines crossing New York State, and the horse-power capacity exceeds the 3,000,000 mark—a total equivalent to that of the tri-utility system recently formed in Pennsylvania by the Philadelphia Electric and associated companies upon the completion of the Conowingo development.

Add the utility systems directly interconnected with this group and the total resources of the zone come to 4,000,000-horse-power. Included in the latter group are the Fall River Electric Light Company, the Montaup Electric Company, the Blackstone Valley Gas and Electric Company, the Worcester Electric Light Company, the Rockville-Willimantic Light-

ing Company, the Western Massachusetts Companies, the Connecticut Electric Service Company, the Twin State Gas and Electric Company, the Vermont Hydro-Electric Corporation, the Public Service Company of New Hampshire, the Central Hudson Gas and Electric Company, the Binghamton Light, Heat and Power Company, the New York State Electric Corporation (until March, 1928, the New York State Gas and Electric Company) and the Monongahela West Penn Public Service Company. Each of these utilities is directly connected with one or more of the systems in the zone proper and thus plays a definite part in the operation of these systems, and as a regular exchange of power is carried on with most of these interconnecting utilities, their generating resources must be coupled with those of the zone utilities to obtain anything like a complete picture.

Most of these companies are interconnected with still other utility systems. Both the Western Massachusetts Companies and the Connecticut Electric Service Company interconnect, for example, with the Hartford Electric Light Company. West Penn connects with others along the power route to the West. Some time ago interconnection was effected between Niagara Falls and Boston by way of the Northeastern Power, Mohawk-Hudson and New England Power System lines.

ELECTROCUTTING THE DOUBTING THOMASES

Quite recently a test flow of power from Boston to Chicago occasioned almost no surprise at all. When the proponents of the Connecticut River Power Company, a present subsidiary of the New England Power Association, built the dam at Vernon, Vt., there were doubting Thomases who frankly said the company could not deliver what they proposed to manufacture to customers in eastern Massachusetts.

But there were also men like Henry I. Harriman, Malcolm G. Chace, George Bramwell Baker and Philip Young, who were eager to direct and finance the enterprise. The line was built, in its day the longest high tension circuit in the world, transmitting Vernon power at the amazing pressure of 66,000 volts to Gardner, Fitchburg, Clinton and Worcester. This was as recent as 1909, and it was then demonstrated that the relatively remote powers of the Connecticut could profitably produce power for use in load centers which would otherwise be forced to rely upon steam, and as hydro power was even cheaper in relation to steam than it is today, the lesson of the Vernon line was not lost upon its operators. Swiftly there followed the development of the Deerfield and the erection of the Shelburne Falls Stations Nos. 2, 3 and 4. In 1912 and thereafter followed the whole chain of Deerfield-Connecticut developments from Deerfield No. 5 in 1914, to Bellows Falls in 1928.

And when the officials of the New England Power Association were ready for the task of generating 425,000,000 k.w.h. per year at Fifteen-Mile Falls, it demonstrated that their predecessors builded better than they knew when they seized the opportunity presented twenty years before on the Connecticut.

The building of "high lines" taught the power pioneers that interconnection of widely separated sources and consumers of power was practicable, and the launching of modern systems of transmission was undertaken.

Ten years before its acquisition of the Rhode Island property, New

England Power had interconnected its lines with those of the Narragansett Electric Lighting Company (now the Narragansett Electric Company), and Connecticut Valley hydro power began to feed into what had been exclusively steam territory since the beginnings of the industry in Providence in 1883. At the same time steam power from South Street, the largest tidewater station between Boston and New York, was available for use in Massachusetts.

Next New England Power tied with a steam system to the southward, this time by running a line down to the Connecticut state line for interconnection with the Eastern Connecticut Power Company, owners of a newly built steam station near the mouth of the Thames River.

The Turners Falls Power and Electric Company, with its important developments on the Connecticut below Vernon, was interconnected at Leverett and as a result New England Power can tap the 200,000 horsepower resources of that system or send power into its lines if the need arises. A tie was made with the Rockville-Willimantic Lighting Company, with the result that the power developed by the New England Association began to flow down into the Connecticut lines of that utility.

An important inter-system tie with Mohawk-Hudson was effected in 1923, opening up the great resources of the Empire State to New England Power. From this source alone the Association obtained over 68,000,000 k.w.h. in 1927 and since Mohawk-Hudson purchased some 77,000,000 k.w.h. from Northeastern Power in the same year, it is entirely probable that power from the far Adirondacks as well as from the Mohawk-Hudson watershed fed into Massachusetts and Rhode Island.

THE BOSTON EDISON TIE

Tie-lines south and tie-lines west were installed, however, without other lines reaching west from Millbury to interconnect the system with the great steam stations of metropolitan Boston, served by the Edison Electric Illuminating Company of Boston. Just as Millbury and Providence began to exchange hydro and steam in 1916 so Millbury and "L" Street began their exchange of these commodities in 1919.

Here again cost reduction was the end in view. There came times when the Boston Edison Company could more profitably buy hydro power from the Deerfield or Connecticut than it could manufacture steam power in its own plants. And vice versa there came other times when the Millbury load dispatcher found it better to save part of his water power and fall back on steam. If his own steam generators were carrying a full load or if he could buy more cheaply than he could manufacture, he turned to the metropolitan system on the east. In principle all power exchange transactions are the same; in all cases their end is to make a profit or reduce a cost.

So there was built a tie between the Vernon line at Clinton and the "L" Street Station of the Edison Company on Boston harbor. Then came the day when the mounting demand for power caused the Boston Edison Company to consider material expansion of facilities and the engineering firm of Stone & Webster was called upon to design and build a steam station on the Fore River at Weymouth. With its installation of 133,150 k.w. and its ultimate capacity approaching 1,000,000 k.w., the new Charles Leavitt Edgar Station—named in honor of the president of the Edison Company and the present chairman of the New England Power As-

sociation board—developed new possibilities in the provision of a steam supply.

In this new station was achieved—and maintained for a goodly period, the world's record fuel rate of less than one pound of coal per kilowatt-hour generated by steam. High pressure equipment, the first of its kind anywhere in the world, combined with large capacity normal pressure equipment to effect this low rate of fuel consumption.

The Edgar Station would have been impractical in the days when the Edison Company began business, as at that time there were definite limitations as to the distance over which electricity could be transmitted.



EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON
Map of System

Sub-stations were required almost every ten blocks, but the development of the alternating system made it possible to distribute current over miles rather than feet. The Weymouth plant provides for tremendous expansion, as the Edison Company owns sixty-two acres of land there. It now uses more than six hundred tons of coal each normal business day at the Weymouth station, and ten times as much water as coal. Salt water from Fore River is used to cool and condense the steam, and about 225,000 gallons, under maximum conditions, pass through the condensers every minute. The present coal storage facilities at Weymouth provide for 100,000 tons equivalent to a five-months supply, but the company's plans call for a storage capacity of 300,000 tons. The wharf fa-

cilities will accommodate an 8,000-ton collier, which with the unloading apparatus installed there, makes it possible to remove a cargo of that size in twenty-four hours. The capacity of the Edgar Station is 138,150 kilowatts, or the equivalent of 185,000-horse-power, and this energy is sufficient to operate 2,760,000 fifty-watt lamps.

From the standpoint of New England Power the Edgar Station meant a new source of low cost purchased power which could be tapped with the permission of the Edison Company. At the same time it preferred to balance its purchases with sales of its own power.

When the officials of the Boston Edison Company threw the switches which put its new 110,000-volt electric transmission lines out of the Edgar Station at Weymouth into service, there was no excitement or special observance in connection with the event which, however, meant the extension of this great transmission service from Weymouth and Quincy through Braintree, Holbrook, Randolph, Avon, Stoughton, Canton, Walpole, Norfolk, Millis and Medway, a total distance of thirty miles. At a substation in Medway connection was made with another transmission line running to Millbury.

The transmission from the Edgar Station to Medway is on two 110,000-volt lines with a capacity of nearly 75,000 kilowatts each, or a total of 150,000 kilowatts. The present service of the New England Power Company from Medway to Millbury is one 110,000 volt line with nearly 75,000 kilowatts of capacity.

The building of this line attracted a great deal of attention as its height and stability was much commented upon as well as the fact that it is carried along its own private right-of-way.

The transformer service in connection with these lines is furnished through two great transformers of 25,000 kilowatts each, which were specially built, nothing of the kind having before been produced.

No doubt had these developments taken place in the South or West pages of newspaper and magazine type would have been utilized to herald the advent of a new day. But that is not the Massachusetts way of doing things.

The 60,000-horse-power newly-developed at Bellows Falls meant to the New England Power Association a comfortable margin between capacity and load, but even the prospect of Bellows Falls power was not sufficient. For any extensive exchange of power with Boston Edison still further capacity was required and so the great undeveloped water-power of Fifteen-Mile Falls was broached, with its potential 300,000-horse-power, at least a part of which could be placed in the market. With the assurance of construction engineers that the development was feasible and that economical transmission was possible, the Association found its requirements met.

BENEFITS OF THE POWER EXCHANGE AGREEMENT

Then came a power exchange agreement between the New England Power Association and the Edison Electric Illuminating Company of Boston, which involved the pooling of the generating resources of both systems and which from a load dispatching standpoint provides a single system extending from Fifteen-Mile Falls, just this side of the Canadian line, to Boston Harbor and Narragansett Bay. Hydro-electric resources of 528,500-horse-power are linked with steam-electric resources of 848,-

466-horse-power to form a single generating system of 1,376,966-horse-power, including Fifteen-Mile Falls. Even without adding New England's steam resources the total would closely approach 1,000,000-horse-power.

Thus the development of the generation, transmission and interconnection arts have combined to produce the largest operating system north of the New York and east of the Niagara units.

Millbury is the chief dispatching center between Boston and Rotterdam. Into the Millbury Station come eleven trunk lines, tying that nerve center with every point in the New England Power generation and transmission system, interconnecting it with Boston Edison on the east, and Rockville-Willimantic, Connecticut Electric Service, Fall River, Mass., Blackstone Valley and Montaup on the south. Lines coming into Millbury from the north tie in Twin State Gas and Electric, Vermont Hydro-Electric and New Hampshire Public Service, while the western lines interconnect systems close at hand—Turners Falls Power & Electric and the Connecticut Valley Power Exchange—as well as the great Mohawk-Hudson System on the west. Thus Millbury occupies a unique position in the system; it has no generators and so it manufactures no power, but not a turbine wheel in the system can turn without word from Millbury nor can a major switch be opened or closed without its assent.

Actually, Millbury is the heart and the most important point on the power route between Boston and Rotterdam, which occupies a similar position in the Mohawk-Hudson system extending from Massachusetts to Syracuse and from the city of Hudson to Lake Champlain. Watertown occupies a similar position in the Northeastern Power System, which operates the Adirondack powers and extends north and south from the historic Mohawk Valley to the Canadian line. Like Rotterdam and Millbury, Watertown has seen its chief load dispatcher participate in the dispatch of power from one end to the other of the Boston-Buffalo line.

In addition to the load dispatching centers, there are switching centers, for the high lines come together many times. Along the main line to Buffalo in New England is Leverett where incoming power from Mohawk-Hudson or from Shelburne Falls may be switched south to Springfield or north to Turners Falls.

In the Boston-Buffalo Zone there is one major network. In earlier days there were many networks and while it was possible to send power from Vernon to Worcester, it was not possible for Millbury to tap resources in the West.

INTERCONNECTION OF POWER

Until very recently, interconnection was confined almost exclusively to the connecting together of generating stations owned in common for the purpose of more economic and more reliable operation. As a matter of fact, in 1892 the Boston Edison Company interconnected its Head Place Station, its Hawkins Street Station, and its Atlantic Avenue Station for these purposes, the efficiency of the latter, located upon tide water and therefore able to use condensing water, being much greater than the other two non-condensing stations, and it was common practice to shut down Head Place and Hawkins Street during certain periods of the year and to secure the entire supply from Atlantic Avenue.

What a difference between 1892 and 1928! In the latter year the Bos-

ton Edison Company participated in an experiment by which the Edgar Station was connected, through Massachusetts, New York, Ohio, Indiana and Illinois with Chicago, and through the states south of the Ohio River leading to Pensacola, Fla., whereby current was actually interchanged over the lines between these distant points. This was, of course, merely an experiment, but it is a forerunner of the future.

It was not until 1918 that the Boston Edison Company entered into a contract with the New England Power Company for the interchange of electricity between the two systems. Millions of kilowatt hours were transferred yearly, either in one direction or another, during the ten-year life of this contract. In the meantime, contracts of the same character only on a much smaller scale, were made with the Cambridge Electric Light Company and with the Eastern Massachusetts Electric Company.

SOME SIGNIFICANT RECENT DEVELOPMENTS

In 1929 the Boston Edison Company constructed a line between the distribution station of the New England Power Association, at Tewksbury, and the Woburn station of the Edison Company, and beginning in the winter of 1929-1930 the latter utility delivered large quantities of electricity to the New England Power Company at Millbury, and the New England unit, in turn, sent over the transmission line to Woburn practically the same amount. This interchange will probably continue for a number of years.

In addition the Boston Edison Company's new contract with the New England Power Association provides for the purchase from that Association of an amount of electricity over a period of years equal in amount to the size of one of the largest turbines which it would be likely to install. As 75,000 kilowatts represent the probable growth of the Boston Edison Company for at least one and possibly two years, this interconnection resulted in postponing the installation of a 75,000 kilowatt turbine for that length of time.

While the management of the Boston Edison Company has no other important interconnections in mind at the present, the possibility and even the probability of further interconnections with neighboring companies are likely to come about in the future.

In 1929 the Boston Edison Company began the erection of an office building at 180 Tremont Street, that is a landmark, due to its great height—200 feet to the top of the pent-house, and its narrow width—28 feet. The structure is fourteen stories high, and is connected with the company's Head Place building by an inclosed bridge from the third to the sixth floors, and as the latter structure is connected with the Edison Building, on Boylston Street, the new structure is easy of access from the other buildings.

The Edison Electric Illuminating Company of Boston has capital of \$53,387,500 and employs upwards of 3,500 men and women. Charles L. Edgar is president, Walter C. Baylies, vice president, Fred G. Havlin, clerk and assistant treasurer, and Thomas K. Cummins, treasurer.

THE GEORGE FROST COMPANY

In 1878, F. Barton Brown was granted a patent on a stocking supporter, which he assigned to George Frost & Co., of Boston, and that



GEORGE FROST

Founder of George Frost Company,
Boston



WHERE THE GEORGE FROST COMPANY,
BOSTON, BEGAN BUSINESS IN 1888



GEORGE FROST COMPANY, BOSTON, 1928

concern manufactured the original men's sock supporter under the name of "Gentleman's Boston Garter." The original product was of the triangular cord type, with a two-tine buckle for a takeup, and twelve gross per day constituted the maximum production, the principal distributing point being New York City.

Until 1887, the concern carried on its operation at 287-289 Devonshire Street, in which year it moved to the third, fourth and fifth floors at 31 Bedford Street, and when the 150 operatives employed there increased to 225 men and women, additional space was secured on two floors in an adjoining building, on Chauncy Street.

In 1889, when Andrew Warren, inventor of the Warren Hose Supporter, died, George Frost & Co., acquired the right to manufacture the product, made improvements on it, and established an auxiliary plant, on Knapp Street. Two years later the George Frost Company was incorporated, and in 1892 moved to its present location at 551 Tremont Street, where it purchased the four-story brick building previously occupied by the Smith Organ Company. In 1895 the original rubber button hose supporter clasp was patented and was marketed under the trade mark, "Velvet Grip," which name has been used ever since. Incidentally, this clasp marked a new era in hose supporter and garter construction. One form was designed by George H. Phelps and another by Robert Gorton, who joined the George Frost Company in 1896. When the merits of the clasp were recognized infringers appeared and for several years the George Frost Company was busy establishing its patents. Finally, a court decision was given which was so broad and positive that infringing ceased almost entirely. In 1906 a five-story addition to the plant was erected and although the corset and waist business, in which the company was also engaged, was sold and the whole plant turned over to the manufacture of Boston Garters and "Velvet Grip" Hose Supporters, it has since been necessary to manufacture in outside mills,—one in Red Bank, N. J., and one in New Britain, Conn., as well as in another building at 557 to 561 Tremont Street, Boston.

Ever since the beginning of the manufacture of Boston Garters for men and "Velvet Grip" Hose Supporters for women and children, the George Frost Company has improved its products, the most important patents being those of George H. Phelps and Robert Gorton.

The commodities have become internationally known through the medium of judicious advertising.

The present officers of the company are Donald A. Chase, president; George B. Glidden, vice president; Leslie M. Woodworth, treasurer and secretary. The corporation has capital of \$950,000 and employs 400 operatives.

A. A. KNIGHTS & SON CORPORATION

In 1878, Alonzo A. Knights and Nathaniel F. Mayo formed the partnership of Knights & Mayo, and began the production of jams, jellies, preserves, flavoring extracts and bakers' supplies, in India Square, removing to larger quarters, at 89 Broad Street, two years later.

Mr. Mayo supervised the manufacturing operations and Mr. Knights constituted the selling force during the first few years, and it was not until 1881 that a regular salesman was employed. A few years later, Mr.

Mayo retired from the firm and it was operated under the name of Alonzo A. Knights, who removed the plant to 9-10 India Street, where more space was available. Here it remained until 1897, when still larger quarters were taken at 87-89 Commercial Street, and Harry W. Knights became a partner in the firm of A. A. Knights & Son.

Upon the death of the father in August, 1889, Harry W. Knights assumed the management of the concern, and the following year the A. A. Knights & Son Corporation was formed, with capital of \$50,000.

In 1918 the business had grown to such size as to necessitate the use of more space, and the five-story building at 803-823 Albany Street, containing 60,000 square feet of floor area, was purchased and occupied. On the death of Harry W. Knights, in November, 1927, his son, Albert J., became president of the company. Fifty hands are employed by the corporation.

In the seventies, rubber-lined, seamless, linen hose was manufactured in Boston by the New England Linen Hose Manufacturing Company whose factory was located in the Roxbury district.

THE CUMMINGS MACHINE WORKS

In 1881 Henry H. Cummings founded the Cummings Machine Works, of Boston, and although he had a partner for a little more than two decades, he was the sole owner for upwards of thirty years.

Between 1885 and 1915 Mr. Cummings was granted more than a hundred patents, the more important inventions contributed by him to American manufactures, being the button-sewing machine which he patented in 1886; the seed-packing machine which he invented in 1895; the printing press evolved by him in 1897; the sub-target gun which he patented in 1903, and the engine-log system devised by him, in 1914. By the latter invention not only the speed of a steamship is automatically indicated, but the distance the vessel has traveled, the direction of the rotation of each propeller, the total average number of revolutions, and the average per minute, are indicated simultaneously and with extreme accuracy. The system excited keen interest in maritime circles here and abroad when it was first tried out and it is now standard equipment on the ships of the United States Navy.

The Cummings Machine Works were incorporated in 1905, and during its nearly fifty years of existence thousands of inoperative inventions have been developed and made successful through the service and coöperation of the designing and experimental machine departments of this concern.

Its executives have been zealous to maintain the most modern equipment, and while the Cummings counters, in all sizes and for all purposes in automatically recording production, constitute an important phase of its activities, together with the manufacture of ship instruments, its designing, drafting, welding, gauge-making, jig and fixtures, pattern-making, carbonizing and hardening departments, are kept constantly busy in experimental work for inventors and patentees.

The corporation has capital of \$50,000, surplus of \$24,000 and employs upwards of sixty skilled mechanics. Irving C. Decatur is president, and L. W. Mustard, Jr., secretary and treasurer.

THE RICHARD YOUNG COMPANY

In 1880, Hon. Richard Young began operations under the name of Richard Young, with capital of \$10,000, the original location being at 75 Gold Street, New York City, and the business that of jobbing leather. The growth was rapid and several moves were made until eventually headquarters were located at 36-38 Spruce Street, in that city.

In 1898, the business was incorporated as the Richard Young Company, with capital of \$250,000, and while the jobbing of leather continued it was gradually replaced by manufacturing. Factories were built and purchased, in Brooklyn, N. Y., in 1909; in Gloversville, N. Y., in 1918; in Peabody, Mass., in 1914; and in Wilmington, Del., in 1919.

Sales branches were established at Boston, in 1890; in Chicago, in 1910; in Cincinnati, Ohio, in 1912; and in Gloversville, N. Y. in 1885.

A variety of leathers for many different purposes is manufactured, each factory specializing on a different product. At the present the lines include *skivers*, for shoe linings, bag linings, pocketbooks, and fancy leather goods, belts, caps, book binding and many other purposes; *sheepskins*, for shoe linings, garments, hatsweats, pocketbooks, and all kinds of fancy leather goods; *horsehides*, for shoes, baseballs, garments, etc.; *genuine kangaroo*, for dress and athletic shoes; *suede kangaroo*, for women's fine shoes; *youngco kid*, for whole shoes and linings; *cowhides*, for men's and women's slippers and shoes; and *calfskins*, for garments and shoes.

The Peabody plant is one of the most extensive units, and was formerly owned by A. B. Clark. When taken over by the Richard Young Company in 1914 it was thoroughly renovated and many additions made, and it is now a completely equipped modern tannery for the production of sheepskins of all kinds.

The Boston branch, established in 1890, has always been a very important distributing point. Its location at Essex and South streets, in buildings owned by Mr. Young, is one of the best in the New England leather district, and a large stock of goods is carried at all times, and distributed to the New England and Canadian trade, which is thoroughly covered by a large force of salesmen. The balance of the country is reached from the New York headquarters and other branches, and an export office is maintained at New York. The company draws on all sections of the world for its raw material and distributes its finished product wherever leathers of this type are used.

The growth of the company is perhaps best illustrated by comparing the original capital of \$10,000 with the present capital and surplus of more than \$2,000,000.

It employs upwards of 225 operatives. Richard Young is president, F. A. Chilton and F. E. Foster, vice presidents, A. L. Gillespie, secretary, and J. J. Gill, treasurer.

THE HATHAWAY BAKERIES, INC.

The name and good will of Hathaway in the baking industry were established at Cambridge, in 1880, when C. F. Hathaway started to produce there a type of bread wholly dissimilar from the so-called "Bakers' Bread" of that period; which was generally a large fluffy loaf without much flavor or substance.

By producing a small, compact loaf and using a high percentage of milk, a standard of bread was produced which was not only very appetizing, but similar to the best home-baked bread of that time.

Starting in a small retail shop, the business expanded so rapidly that within six years a new and larger plant was required, and Mr. Hathaway bought a factory in Waltham in the early nineties. As his four sons reached manhood, they joined him in the business, and formed the partnership of C. F. Hathaway & Sons.

In 1912 the firm acquired the Best Baking Company located at Roxbury, and increased the distribution of bread and cake to sections south of Boston.

In January, 1926, the Hathaway Baking Company was formed and acquired all the assets and the three Greater Boston plants of C. F. Hathaway & Sons, the Grocers Baking Company and the Grocers Food Company of Providence, R. I., and the Boeltger Bakeries of Utica and Syracuse, N. Y. In July, 1926, the Dube Baking Company, of Salem, was bought and in August, 1926, the Grocers Bread Company of Worcester.

In March, 1928, the Hathaway Bakeries, Inc., were incorporated and took over all the assets of the Hathaway Baking Company, the Community Bakeries, Inc., with plants in Brighton and Brockton, and the Dolly Madison Baking Corporation, of Springfield.

In February, 1929, three plants of the Wehle Baking Company and Wehle Bros., located in Rochester, N. Y., Youngstown, O., and Milwaukee, Wis., were added, and in November of the same year a plant in Pittsfield was acquired, and Hathaway Bakeries, Inc., now operates fifteen plants, ten of which are in New England, and the combined assets of which are in excess of four and one-half million dollars.

From these various acquisitions of prosperous, going concerns the company has been able to select able executives and to build up an excellent personnel and competent management.

The concern does a general baking business and bases its success upon the manufacture of high quality and uniformly good products and produced from the same materials and with the same care as the home-baked commodity. The company is a Massachusetts corporation with general offices at 10 High Street, Boston.

Its plants in Massachusetts are located in Cambridge, Roxbury, Waltham, Brighton, Brockton, Taunton, Springfield, Worcester, and Salem. The present officers are: president, Alton H. Hathaway; vice president and general manager of Eastern plant, Walter H. Dietz; vice president and general manager of Western plants, Louis A. Wehle; treasurer, A. B. Hastings, Jr.; assistant treasurer and purchasing agent, Elmer F. Hathaway; clerk, Charles S. Tupper.

The board of directors include: Alton H. Hathaway, A. B. Hastings, Jr., Walter H. Dietz, Louis A. Wehle, Frank Eighthme, Leon M. Gardiner, Arno Geiser, William H. Boeltger and Lyman Frazier.

THE HENRY K. BARNES COMPANY

Henry K. Barnes, a native of Cambridge, whose father had died when his son was but twelve years of age, assumed the responsibility of supporting his widowed mother, and ultimately became a salesman for the Union Glass Company and the Henry C. Hunt Belting Company. In 1876,

when twenty-nine years of age, he started in the belting business in a small way as the Eliot Barnes Company, occupying the basement at 201 Devonshire Street where the Boston Safe Deposit & Trust Company is now located.

Mr. Barnes assumed charge of the selling, and left the financial and office work to others. Returning to the office from a sales trip, he learned that an attachment had been placed on the business. That night he took the company's books home and examined them thoroughly and later prevailing upon a customer-friend, E. E. Truesdell, of Suncook, N. H., to lend him \$5,000, he started over again as "Henry K. Barnes, Belting, Mill Supplies, etc.," locating his belt shop in the loft of 201 Devonshire Street, with Washington H. Godfrey as his foreman. One of his employees, Jacob Schoelch later became his superintendent, it being Mr. Barnes' policy to give every chance to his workers to demonstrate their native ability, and as he displayed a keen interest in his employees, his efforts produced many excellent executives and production men.

Through the persistent urging of Mr. Schoelch, a mineral, or chrome tar, was added to the oak tannage, as Schoelch discerned the possibilities of this type of product in leather belting and aprons used in the worsted and woolen industries. At that period, the tannery and factory now owned and operated by the concern was acquired at 7 Irving Street, Salem.

On November 30, 1909, the founder incorporated the Henry K. Barnes Company under the laws of Massachusetts, with a capitalization of \$95,000, and gave his employees the opportunity to acquire some of the stock.

When the building at 201 Devonshire Street was torn down, the corporation moved to 234-236 Devonshire, where are now located the executive and sales offices.

Mr. Barnes died July 11, 1914, and his stock was acquired by Charles A. Choate, Charles A. Rideout, Walter M. Ray, Arthur D. Hitchings, Justin A. McCarthy, and one or two others, all employees of the company. Under the capable leadership of Messrs. Choate and Rideout, both since deceased, the Barnes policies were continued.

With Arthur D. Hitchings as president, Walter M. Ray as vice president, secretary and factory manager, and E. Harry Landberg, as treasurer the high standards of the founder of the business are now being carried on.

At the tannery and factory about 35,000 square feet of manufacturing space are utilized, and about fifty men are employed. Special tan belts, such as mineral or chrome, gam-oil, combination tan and oak tan, are tanned and manufactured by employees who have been with the concern for years, and who are familiar with all kinds of driving conditions. Barnes' mineral tanned belts for difficult, wet drives are known the country over.

Many years ago the founder added the manufacture of fire hose and fire fighting equipment of every description to the products, and the Henry K. Barnes Company has become headquarters for this equipment, under the capable management of Justin A. McCarthy. Barnes' quality fire department hose has been known and used extensively for years by cities and towns all over the New England states.

THE D. B. UPDIKE MERRYMOUNT PRESS

Less than four decades ago there was established in Boston an institution which is better known to connoisseurs of printing the world over than that of any other establishment in America.

It was not founded as a personal hobby, subject to private subsidy, but rather as a commercial undertaking uniquely directed, by a printer singularly endowed with a ripe typographical scholarship, and those rare accomplishments, practical capacity, and a discrimination susceptible to the beautiful in all its varied forms.

The question often arises whether the choice of the name under which it has operated since it was founded, in 1893, implied an attitude of protest, for when Daniel Berkeley Updike created the Merrymount Press, he named it after an estate located in Wollaston, that was owned by a somewhat self-willed gentleman who flaunted various time-honored but indecorously gay customs, such as Maypoles, in the faces of his horrified Pilgrim neighbors.

While it came into being in what today are referred to as "the gay nineties," the levity of that decade certainly did not extend to American printing, which at that period was unmistakably dead.

Mr. Updike spent his boyhood in Providence, R. I., his ancestors having settled in that state in the seventeenth century on land still held by their descendants, and they produced, in succeeding generations, several men who played a prominent part in the political and social life of Rhode Island.

D. B. Updike was uncertain of his future at eighteen years of age. He had chosen no vocation; he had no idea of what he might do, but he faced the necessity of going to work. It was at that time that a Boston relative procured a place for him in the publishing house of Houghton, Mifflin & Co., and here he began his career, in 1881, first, as an errand boy, next as a clerk, and finally in helping to prepare catalogues and in arranging advertising materials, title-pages and a few books.

At the age of thirty, he believed he was equipped to take his chances in the world of independent business, and he was one of those who early discovered that success lay in finding and following his own personal style.

And so in 1893, without a pound of type, a hand-printing press or an ounce of material he began business at 6 Beacon Street, his sole capital at that date being the taste of the founder, his enthusiasm and ideas, and a happily chosen name, which became the emblem of the press, and which, as Mr. Updike has said, was "intended to signify that one may work and yet have a good time."

The first work of the press was designed for customers and turned over to regular printers to be executed, but a year or two later, Mr. Updike began acquiring type and material in small volume. It was then that he decided to undertake, with the aid of an old Rhode Island friend, the late Harold Brown, an ambitious piece of work—an Altar Book, the decorations and initials of which were designed by the late Bertram Goodhue, and for it he also created the Merrymount type—the first special font cut for Mr. Updike.

A little later he revived the use of what is termed Scotch-cut type in this country—originally produced by Alexander Wilson about 1835, and first used by Mr. Updike in the works of Edith Wharton, who insisted that

her publishers, the Scribners, should have her early volumes printed by the Merrymount Press.

For a series of volumes known as the Humanists' Library, long since out of print, Herbert Horne of London designed a font of type which Mr. Updike termed Montallegro. Then followed notable fonts of type, including some seventeenth century Dutch fonts by Janson, and the matrices of the Mountjoy type, as well as a collection of ornaments assembled from type foundries all over the world which probably exceeds any similar group of typographical units in the United States.

After a few years in a pleasant old home round the corner, in Tremont Place, succeeding the 6 Beacon Street location, the Press moved to 104 Chestnut Street, where in due time the next house was added to the plant, but soon after the beginning of this century these quarters were outgrown, and in 1903 the present plant at 232 Summer Street, opposite the South Station, was acquired.

Mr. Updike was fortunate in selecting as one of his original assistants, John Bianchi, a man of unlimited good will and practical ideas, who proved to be exactly the sort of helper needed by an entrepreneur in printing who possessed imagination and the artistic sense.

In 1915 Mr. Bianchi became a partner in the Merrymount Press, and is now its managing head, having been an influencing factor in forming its sound and practical policy.

Some years were required to mature the highly individualized style of the founder, which is notable chiefly for its dignity, simplicity, agreeable variety and restraint, but behind which is a distinctive, positive personality that radiates qualities of good taste, scholarship, strength and sureness.

But ere long the Merrymount Press won its own pre-eminence and advanced into a distinction too wide to be circumscribed by the approval of any special group.

Walter Prichard Eaton, writing in *The Bookman*, has paid this tribute to the founder of this internationally known enterprise:

"Updike, it seems to me, is to American printing much what men like McIntyre and Bulfinch were to American architecture; he has strength and simplicity combined with great delicacy and restraint; he can be, and always is, graceful and refined without losing any essential power or virility; he is classic without sacrifice of his own personality. His influence on the better class of American printers has been great, and it has been a steadying influence, toward classic fitness and simplicity and the charm of a pure style."

The Merrymount Press has grown from small beginnings to its present proportions because it has endeavored to hold to the principles that all work undertaken is to be done well and that commercial work may yet be artistic. The confusion in the public mind as to what makes work artistic, and what makes it commercial, is based upon the vague impression that nothing really useful can be artistic, and that nothing really artistic can be made commercially. In spite of some amusing legends as to what it does or does or does not do, the Press has been, and is, a commercial press which accepts whatever work comes to it, though never without the endeavor to do it better than is usually thought worth while. Every kind of work has been undertaken, from the advertisements of muffins to the Agricola of Tacitus,

When the *London Times* signalized its forty thousandth issue, on September 10, 1912, it reviewed the "Progress of Modern Printing in the United States," and in speaking of the Merrymount Press, it said:

"The work of Mr. D. B. Updike at the Merrymount Press, Boston, on the whole best typifies the trend of our efforts of recent years. Beginning with the Kelmscott influence strongly felt, though never slavishly copied, Mr. Updike has in turn based his work upon mediæval styles, as evinced in some of his liturgical work, upon Renaissance models, as shown by his 'Altar Book,' 'Tacitus,' and 'Humanists' Library,' and more recently upon English and French work of the eighteenth and early nineteenth centuries.

"The latter may, perhaps, be taken as his most characteristic contribution to the art, and it is far from being a mere echo of those periods, but is a genuine transmutation of their best work to Mr. Updike's own purposes. His unerring sense of style carries him over pitfalls into which printers less sure in taste and knowledge flounder long and in some cases never escape. We may not always care for the form in which certain of his books are cast; but, once granting the style, we may be sure that Mr. Updike has followed it consistently—always, however, infusing into it his own humility and modernity.

* * *

"Mr. Updike's most admirable results have been achieved with a type patterned on a late eighteenth-century letter. For distinctly modern work this has perhaps no equal, as it lends itself to a great variety of treatment. It is used at the Merrymount Press with great skill in arrangement and fine sense of proportion.

"Some of Mr. Updike's most characteristic and delightful productions are amongst the minor pieces of miscellaneous work which he sometimes undertakes. Here he gives his somewhat whimsical fancy a little more play than in the books, and he prints catalogues, programmes, menus, announcements, etc., which are eagerly sought after by collectors of typography.

"The Merrymount Press is the only example in America of a press established upon a commercial basis yet devoted exclusively to fine work; preserving with perfect integrity the high standards of the private press, and combining the feeling of the amateur with the sureness of the professional."

The enterprise stands unique and alone among American print shops. Mr. Updike created the enterprise after a pattern of his own, and unhampered by any great knowledge as to how it should function, a factor which provided him at once with great freedom of technique. One writer has said: "His equipment for the adventure seems to have been an æsthetic predilection, a philosophy of life and periods."

No doubt he looked upon the career of a printer as an activity within the domain of art, but he was convinced that no toy or artistic press would long survive and that if he were going to foster a real business, it was essential that it should live as other enterprises thrive and grow—by making things and selling them. And so he wedded commercial activity and an art, and created a Press that was neither imitative, antiquarian or archaic. What is more he has deliberately succeeded in keeping it small against the urgings of people who have seen in its phenomenal success an opportunity for it to expand into something commensurate with the tendency of the times in practically all industrial lines—mass produc-

tion. Such a course would not permit its products coming under the watchful eye of one person.

The family of employes remains the same, year after year, and there exists a very human relationship between employer and workman. Any attempt to enumerate the customers of the Merrymount Press would be to write a "Blue Book" of American colleges and universities, hospitals, foundations, institutes, religious bodies, museums, societies, banks, publishing houses, industrial corporations, and the leading men and women of America, while the range of products covers the fields of art, biography, essays, and literature, genealogy and family records, history and literary history, the drama, war books, books in series, and school and college catalogues.

The medal of the American Institute of Graphic Arts for the "fifty best books" each year was received by the Merrymount Press for four books in 1923; for eight books in 1924; for five in 1925 and for six in 1926.

The walls of the reception room, the library, office and work rooms of the enterprise carry Mr. Updike's collection of fine early printed books, old type specimen sheets, rare volumes on typography, portraits of great printers, and like priceless treasures.

Besides his lectureship at the Harvard School of Business Administration, Mr. Updike was for some years president of the Society of Printers in Boston, and is one of the honorary vice presidents of the Society of Graphic Arts. He is an author of note, a just and keen critic of design throughout the entire gamut of the fine arts, a connoisseur of life, a good judge of men, a retailer of anecdotes, and a very human soul, a man of no school, not a graduate of a major institution of learning, but a finished scholar, with an adequate technique of research and criticism.

Any institution or business enterprise in America that can look back upon an unbroken history of nearly four decades takes on much of the dignity and permanence that attaches in Europe to ten times that number of years, and so it is that the Merrymount Press has become more than a mere manufacturing establishment. It has an historical and cultural interest for the general public.

The style of the work is directed personally by Mr. Updike, who sees practically every page of every book, and each detail of every piece of printing that is done at the Press. An economy of means and a sort of disciplined sobriety mark its product; and this comes about, probably, through aiming at suitability—a quality which involves discarding whatever does not organically belong to the particular work in hand. For in the final analysis, it has been axiomatic with the founder that printing must "not be merely good, but good for something;" and that "something" is its purpose.

Work has been executed at the plant in Greek, Latin, Russian, Swedish, and most modern languages. An elaborate outfit of diacritical marks, as complete as any in the United States, enables the Press to print transcripts of early manuscripts or to reproduce the characters peculiar to early typography.

THE LYND-FARQUHAR COMPANY

In 1882 the firm of Chandler & Farquhar was established to deal in machinists supplies, and five years later machine tools were added.

The business grew to such an extent that it was deemed advisable to separate the two departments, and the original firm continued the supply business, while a new corporation, The Lynd-Farquhar Company was created, February 1, 1917, to take over the machine tool activities.

Charles S. Farquhar became treasurer of the latter concern at its organization, and upon the death of President Robert J. Lynd, in August, 1925, he was chosen to succeed the latter, and holds both positions today. Howard L. Rich is vice president and Harold L. Furber, secretary.

The corporation has capital of \$100,000 and is the exclusive Boston representative of several of the largest machine tool manufacturing concerns in this country.

THE IMPORTANT INVENTIONS OF JOHN REECE

The development of the ready-to-wear clothing industry, which had its rise in Boston during the Civil War when uniforms for the Union Army were produced demonstrated that one of the most tedious and expensive operations in the manufacture of clothing was the hand-method of completing the buttonholes. Many attempts to fashion these necessities by machinery were undertaken, and the best known pioneer inventor was John Reece, of Boston, who, in the early eighties, evolved a machine which cut and worked buttonholes in one operation.

Many years passed before he succeeded in making the device mechanically perfect, and Mr. Reece encountered difficulties not unlike those experienced by Elias Howe, when he invented the sewing machine.

The wholesale producers of clothing were reluctant to make use of the Reece apparatus, as the tailors objected to the introduction of machine methods. Ultimately, however, the resistance was worn down and today the Reece machines are used in fashioning buttonholes for all types of fabrics, from the flimsiest peek-a-boo garment to the heaviest material used in ulsters and furs. Only the experienced expert can detect the difference between the work of the Reece buttonhole machine and that of the most skillful journeyman tailor.

Mr. Reece next turned his attention to the development of a machine that could sew shoe buttons and patented a practical and efficient device now universally used in the shoe industry. This invention was followed by a folding machine, designed and patented by Mr. Reece. The Reece Buttonhole Machine Company has its plant at 502 Harrison Avenue, where 500 operatives are employed in the manufacture of buttonhole machinery. The corporation has capital of \$1,000,000.

Associated with it at the same location is the Reece Folding Machine Company, which is also capitalized for \$1,000,000, and which employs twenty-five operatives. Francis A. Shea is president of both corporations; George C. Hill is secretary; and Franklin A. Reece, treasurer and Theophilus King, John Reece, Francis L. Cady, and George Peterson constitute the board of directors of each.

The Reece Shoe Machinery Corporation, with capital of \$1,000,000 of which F. A. Shea is president, John Reece, treasurer, and G. C. Hill secretary, and the International Buttonhole Sewing Machine Company with capital of \$500,000, of which F. A. Shea is president, and G. C. Hill, secretary and treasurer, also operate at 502 Harrison Avenue, the former concern controlling the Reece buttonhole machine patents in foreign countries.

GODFREY L. CABOT, INC.

Upon his graduation from Harvard in 1882, Godfrey L. Cabot entered the employ of his brother, Samuel, who was then engaged in the manufacture of coal tar products in Chelsea. That year, Samuel Cabot became interested in a small plant manufacturing carbon black from natural gas at Worthington, Pennsylvania, and Godfrey L. Cabot was made superintendent of the unit. Five years later he bought it and continued the business as sole owner and manager, until 1922, when it was incorporated as Godfrey L. Cabot, Inc.

The business was expanded largely out of earnings, and other plants were built or acquired in Pennsylvania, and West Virginia. It was Mr. Cabot's policy at each factory to assure a cheap supply of raw material by acquiring gas land, drilling his own wells, and conveying the gas to his plant through his own pipe lines.

The carbon black industry is necessarily nomadic, being dependent on a cheap supply of natural gas, which has a limited life in any given field. As the demand for gas for domestic and industrial purposes in the larger cities increased, the gas companies supplying these municipalities built mains further and further afield for gathering natural gas to augment their supply, and the market price of the commodity in the Pennsylvania fields eventually reached a point where it was more economical to close the plants there and sell the gas to the public utility companies. New factories were built by Godfrey L. Cabot, Inc., in the more remote fields of West Virginia to take their place.

In 1900, Mr. Cabot began the construction at Grantsville, West Virginia, of a factory which was for many years the largest carbon black plant in the world, and from which the product was teamed and boated down the Little Kanawha River forty miles to railhead. Shipments could not be made except at high water and customers were asked to give six months' advance notice of their needs, which is in vivid contrast to the twenty-four hour service required today. Mr. Cabot gradually acquired an extensive pipe line system and drilled a large number of gas wells for supplying his plant and other West Virginia factories. His Pennsylvania units were all closed by 1910 and the gas properties there were sold in 1920.

About 1915, it was discovered that carbon black had a remarkable property of reinforcing rubber compounds, the abrasive resistance of rubber containing carbon black being more than twice that of rubber without it and today no automobile tire that does not carry a carbon black compound in its tread can compete with those employing this commodity. Due to this discovery, and to the stimulation of trade in general, the industry grew many fold during the World War.

Becoming interested in aviation, Mr. Cabot bought an airplane in 1915 in order to enhance the national interest in aerial preparedness, and he entered the Naval Reserve in 1916, and went into active service April 1, 1917. During his absence the business languished, several of the plants were shut down and permanent contracts were let for the sale of gas to large public utility companies for resale to industrial consumers. At the end of the war the company was producing only about 3% of the world's carbon black production as against 30% before hostilities began.

Since the Armistice, the sale of gas to the companies supplying Pitts-

burgh, Cleveland, Columbus, and other cities has been the principal part of the activities of Godfrey L. Cabot, Inc., east of the Mississippi. The West Virginia gas properties have been gradually extended and comprise 500 miles of pipe lines, 400 gas wells, twenty-five oil wells, 130,000 acres of gas lands, and several plants for the distribution of gas to domestic and industrial consumers in the smaller cities of West Virginia. About 94% of the company's gas production is sold at wholesale to public utilities and 6% locally to domestic and industrial consumers.

Late in 1925 the company entered the carbon black manufacturing business in Texas, and the construction of a plant at Eliasville, Texas, was started in January, 1926, by a subsidiary company. Since that year, the carbon black production of the company has grown rapidly and is now running at a rate of 75,000,000 pounds annually, or about 25% of the world's production, or more than ten times as large as in 1914. The gross sales of the company are over \$7,000,000 annually as against \$4,000 in 1887.

The company's gas properties in West Virginia located in Harrison, Doddridge, Ritchie, Calhoun, Gilmer, Wirt, Wood, Roane, Nicholas, Fayette, Kanawha, Raleigh, and Boone counties, are owned by Godfrey L. Cabot, Inc. In addition, the corporation controls three gas companies,—The Kanawha Valley Products Company, The Monarch Carbon Company, and The Wak Company, and a gasoline unit—Salem Gasoline Company—all operating in West Virginia.

Carbon black plants operated by other subsidiaries are located at Eliasville, Pampa, Kingsmill, Skellytown, and Stinnett, Texas; Seminole, Oklahoma; and Baker, Montana.

Godfrey L. Cabot is president; James J. Cabot is vice president; and Thomas D. Cabot is secretary and treasurer of the corporation, and the Boston office is located at 940 Old South Building. The concern employs 350 hands.

THE STURTEVANT MILL COMPANY

In January, 1883, the late Thomas L. Sturtevant organized the Sturtevant Mill Company, and began operations in a leased basement in Hyde Park, with its offices on Kilby Street, Boston.

Nine years later the founder erected a part of the present brick plant, in Harrison Square, originally occupying the basement only, and renting the upper floor. A few years later the business demanded larger quarters, and the lease was cancelled and additional machinery installed. Shortly after, another story was added, followed by another building, and ultimately a third structure was erected.

During the period of the World War, two new concrete shops were built on the opposite side of Park Street to take care of growing demands, and at present the company utilizes about 70,000 square feet of space, while the number of employees has increased from a half dozen to three hundred.

The plant equipment consists of 125 or more machines for crushing, grinding, separating, weighing, mixing, elevating and conveying, and the business has become international as well as national, offices being maintained in New York, Pittsburgh, Atlanta, and San Francisco, with associates in London, England, who manufacture its products for the European field, and it maintains representatives in most of the foreign countries.

The company has an engineering staff engaged in designing, erecting and operating complete plants, and in producing special equipment, in addition to the regular machine work for local trade.

The enterprise traces its success, particularly in connection with the international reputation of its equipment in the process industries, to the ingenuity and inventive genius of its founder, Thomas L. Sturtevant, who was a pioneer in the fertilizer industry at a period when little or no machinery was available in that field. He designed and built many machines for use in fertilizer plants, some of which are in use today, and it was his interest in machinery and the possibilities he saw in the production of labor-saving equipment in that and other industries that led him to resign a lucrative position he held as treasurer of the Bowker Fertilizer Company of which he was one of the founders, and to incorporate the company bearing his name, thus giving free rein to his mechanical bent.

His contributions resulted in the granting to him and to his associates of some three hundred patents, and the development of a complete line of original and labor-saving mechanisms unique in concept, many of which have become standard equipment and have revolutionized the industries they have served, including crushing, grinding, separating, mixing, elevating and conveying devices.

The company's activities have not, however, been confined to its own patented devices, as it has sent its representatives abroad to investigate and purchase the American rights to equipment and processes that it was believed would round out its line of machinery.

Some years ago, when the company appreciated that all machinery installation requires the services of skilled engineers, it seemed desirable to render a service of that nature to its customers, and it created a division known as "Sturtevant Engineers," which operates entirely independent of the Mill Company, and yet is closely associated with it, and the main function of which is to render highly important engineering advice in the selection, arrangement and installation of equipment. This unit is operated on the stage basis, each stage being separate and distinct from the others, the clients employing the Sturtevant Engineers to do work in one stage at a time only, at a predetermined cost, with the privilege of continuing or abandoning work at the end of each stage, the group being the first to successfully operate a plan which enables the consumer to be given a known and fixed price in advance of the employment of the group.

This has proved to be an innovation second to the value of the Mill Company's patented equipment, and affords clients exact knowledge of what the actual cost of plant or equipment will be in advance of payment.

At the present, this staff consists of twenty-seven engineers, with whom are associated many independent engineering specialists in allied lines to reenforce their engineering equipment. In addition to the service, the designing engineers of the Sturtevant Mill Company are continually developing and building special machinery for customers, this work being a business in itself.

From a small beginning, the enterprise has become not only a large manufacturer of machinery, but it has developed an important engineering organization of world-wide ramifications. The corporation has capital of \$1,000,000, and the present officers are L. H. Sturtevant, president and general manager; T. J. Sturtevant, vice president and chief engineer; W.

H. Ellis, treasurer; William T. Doyle, manager of the engineering department; H. A. Tomlinson, manager of the sales department; John Lundgren, superintendent of the machine shops; A. J. Towle, superintendent of the sheet metal shop; and George Towle, purchasing agent.

THE WALTER M. LOWNEY COMPANY

In February, 1883, the late Walter M. Lowney began the manufacture of bonbons in his own name and with small capital, at 89 South Street, Boston, in a building of four stories and a basement with thirty feet front and less than thirty feet in depth. At the end of the first eighteen months he was employing fifty persons. From this small beginning came a period of rapid and almost spectacular growth.

In 1886 the plant was moved to the corner of Pearl and High streets, and in 1890 included numbers 87-107 Pearl Street. That year the business was incorporated under the name of The Walter M. Lowney Company. Expanding sales effort, backed with advertising, began at the time of the Chicago World's Fair, in 1893, and the company erected a building of its own in the Court of Honor at the Exposition. There was a steady period of material growth, including the setting up of such important mile-stones in business as the factory on Commercial Street, corner of Hanover, in 1898; its increase in 1901; the inclusion of a paper-box factory in 1902; the establishment of The Lowney Chocolate Company in Mansfield, in 1903, as the outgrowth of one department, and the incorporation of The Walter M. Lowney Company of Canada, Ltd., in Montreal, in 1906. For years a retail store was operated at 416 Washington Street, Boston, the site now being included with others in the Filene Building.

The various plants at Boston, Mansfield and Montreal have been enlarged by the addition of new buildings and are capable of immense outputs of chocolate and chocolate confectionery. The Boston unit is operating as The Walter M. Lowney Company, the Mansfield plant as The Chocolate Refiners, Inc., and the Montreal factory as Walter M. Lowney Company, Ltd., the last named being now almost entirely a Canadian-owned corporation.

From a small beginning, sales connections have been established throughout the United States and Canada and in foreign countries where American chocolates can be exported to advantage. Over a period of years large sums have been expended in national and local advertising in newspapers, magazines, trade expositions and the radio. Gold medals and medals of honor were awarded to Lowney's at the World's Exposition at Chicago, in 1893; at the Pan American Exposition, at Buffalo, in 1901, and at the Panama-Pacific Exposition, in San Francisco, in 1915. The company maintains a sales force of about fifty men throughout the country carrying its lines of chocolate confectionery, chocolate coating, and cocoa powder, dealing principally with exclusive distributors in all sections and specializing on a line of high-grade chocolates. It has branch houses in New York, Chicago, and Columbus, Ohio, and many of the sales connections are of long standing and the strongest in their respective sections.

The Lowney history is one of growth from small beginnings, and the company is credited with initiating and marketing package candy in a large way. It is probable that the present common practice of cooling

chocolate dipping and chocolate packing rooms was first employed by this company.

W. H. Raye is president and treasurer, Walter H. Belcher, vice president and director of sales, and W. C. Chisholm, clerk of the corporation, which employs 1,000 operatives in its several factories. The general offices are at 427 Commercial Street, Boston.

SYLPHO-NATHOL AND THE SULPHO-NAPTHOL COMPANY

Two hundred and fifty years ago a new world was uncovered by an obscure man, whose name is almost unknown today—Leeuwenhoek, a native of Holland, maker of fine lenses, and discoverer of the world of microbes. For the next hundred years after he astonished the scientists with the reports of what he saw through his powerful microscopes, little more was learned of the habits and characteristics of these tiny beings.

In 1873 the most eminent physicians were unable to explain the cause of epidemics. At that time, Louis Pasteur, in France, and Robert Koch, in Germany, were devoting their lives to research and experimenting with microbes. The latter was the first to prove that a specific type of microbe caused a certain kind of disease, and it was he who announced to the world that microbes were the causes of illnesses of certain types, but it was Pasteur, with his vision and imagination, who prophesied that the day would come when preventive measures would arrest plagues.

It was dangerous business—experimenting with deadly germs—and to protect themselves against infection the scientists used bichloride of mercury, which wrinkled and blackened their hands.

News of the remarkable discoveries made by Pasteur and Koch spread to all the laboratories of Europe and crossed the ocean to America, and the germ theory, with all it has entailed, was launched.

Lister, prince of surgeons of his era, followed the work of the scientists with much interest, and learned that eight out of ten upon whom operations were performed died from some type of infection. He worked on the problem of preventing germs entering a wound, and in this direction made considerable progress, his method being to sterilize with crude carbolic acid.

Dr. Samuel Cabot, a surgeon in the Massachusetts General Hospital, observed the progress of antiseptic surgery as developed by Lister, but realized the limitations of carbolic acid, which did not produce a thorough solution when mixed with water and which sometimes caused gangrene. He conferred with his son, a manufacturing chemist regarding the need of a product that would kill germs but would not be destructive to human tissue.

After many months in his laboratory, Samuel Cabot, father of the present Samuel Cabot, evolved a process for preparing such an antiseptic—the first emulsifiable creosote disinfectant—which he called Sulpho-Napthol, and, in 1884, a patent was received.

The materials first used in the manufacture were then known as naphthaline oil and sodium sulphide to which was added a soap base. As the years brought greater knowledge of the product, improvement in materials and processes have been made from time to time, until today a stronger disinfectant, clearer and lighter in appearance, and whiter and more permanent in solution, has been produced.

As knowledge concerning germs became more common, the use of

Sulpho-Naphthol extended from the hospital to the home and the enthusiastic appreciation of users resulted in a growth and expansion which the product has ever since enjoyed.

The other commodities manufactured by Samuel Cabot, consisting mostly of shingle stains, deadening quilt and wood preservatives, were of an entirely different nature than Sulpho-Naphthol, and the trade which they supplied—hardware and building—did not offer a logical outlet for a disinfectant.

Consequently, in 1895 The Sulpho-Naphthol Company was incorporated for the merchandising of Sulpho-Naphthol, and on January 23, 1900, Isaac H. Locke was elected president and still holds that office.

The early sales efforts were directed towards expanding the sale of the material in bulk, to hotels, institutions, office buildings and factories, and to some extent, stables. When Mr. Howe, a former grocer, came into the business, he arranged for distribution through stores to the family trade, and when druggists began to buy Sulpho-Naphthol in gallon or five-gallon quantities to dispense in smaller packages ranging from one to thirty-two ounces, the desirability of marketing the commodity in bottles for family use and recommending it as a household disinfectant and antiseptic became apparent. The support of physicians was sought to prescribe Sulpho-Naphthol in the treatment of cuts, wounds and sores, and in 1900 it was definitely recognized that the bottle business, then distributed only through the drug trade, offered much greater opportunity than the bulk trade. Distribution of package goods steadily expanded and in 1908 the sale of Sulpho-Naphthol was established in all of the larger cities of New England, somewhat in New York, Philadelphia and beyond. Today the product may be purchased in almost any town throughout the country.

In 1912 the name was changed to Sylpho-Nathol, since, because of improvements in the process of refining, a sulphur compound was no longer used in the manufacture.

A few years ago Sylpho-Nathol was combined with iodine in ointment form and this new product has since been marketed as Sylpho-dine, which enjoys complete distribution in New England and is now being marketed in the rest of the country.

Isaac H. Locke is president, R. B. Locke, vice president and secretary, and Isaac Locke, treasurer, of the corporation, which has capital of \$120,600.

THE SAMSON CORDAGE WORKS

The invention in 1884 by James A. Tolman of a new style braiding machine was responsible for the development of a business which today affords employment to 500 operatives, at plants located in Shirley, in this state, and in Anniston, Alabama. Mr. Tolman originally began manufacturing operations in a small factory located at 164 High Street, Boston, and he placed his commodity on the market at a period when the uses of braided cord were few, although similar products had been on the market for fifteen years before.

By judicious advertising and effective salesmanship, the display of courage, imagination, and hard and persistent work the concern prospered, and four years after he began business the Samson Cordage Works were incorporated, with capital of \$80,000, Mr. Tolman being president, and Herbert G. Pratt, treasurer.

In 1888 an idle mill, erected in Shirley, by the Shirley Shaker Community, about 1850, and which was devoted by that group to the manufacture of coarse cotton cloth, was purchased by the Samson concern, and the spinning equipment installed therein was employed to produce the cotton yarns used by the company's braiding machines.

Then came the financial depression of 1893, with the temptation to produce a cheaper commodity, but Mr. Tolman had determined upon quality cordage, and he was not swerved in his decision that the standard established by him a decade before must be maintained. He had been marketing his products under the trade-mark of "Samson and the Lion," and, in 1895, a new designation was adopted, "Colored Spots Applied to Sash Cord," which was regarded as more clearly descriptive of the commodities than the former. The capital of the company was increased from time to time, and the business grew, despite severe competition from southern mills where cheap labor gave factories there a decided advantage.

To meet this handicap, the Anniston Cordage Company of Anniston, Ala., was purchased by the Samson Cordage Works, in 1910, and during the past twenty years the business of the concern has grown amazingly, the company even showing growth during the difficult period of the World War, and it successfully weathered the post-war deflation period of 1920.

The company has been fortunate in its dealings with its employees, having had but two strikes since it was formed, each of but a few days duration, and both were settled in favor of the management which convinced the workers that it had correctly stated the actual conditions.

The volume of sales is now more than twenty times greater than in 1888, when the plant was removed to Shirley, and the lines of production have been extended to include Samson Spot Sash Cord, Samson Solid Braided Lines, Glazed Cotton Twine, Sash Cords, Clothes, Awning and Masons' Lines, Shade and Loom Cord, and other braided cords for all uses. It also operates a third plant, at Sherbrooke, Canada.

The founder of the concern died in 1915, since which time Herbert G. Pratt has been president and treasurer. F. J. Coakly is secretary, E. S. Pratt, vice president, and W. R. Dewey, Jr., assistant treasurer. The company has its main office at 89 Broad Street, Boston, and has capital of \$1,500,000.

THE CHARLES N. MILLER COMPANY

The nationally-known Charles N. Miller Company may be said to have been built upon a musical foundation, inasmuch as its sponsors conceived the idea of forming a family quartet of brass instruments, whose engagements at country dances, church suppers, and entertainment programs not only enhanced the income of the father and three sons, but led to a removal from Framingham to Somerville, where Charles N. Miller, at the age of fourteen, began work at \$3 per week in a shoe factory, where his father, Charles H. Miller, was employed as foreman.

Reading the newspapers for a business opportunity, Charles N. Miller saw an advertisement offering a half interest in a jobbing candy route, in return for a horse and buggy, whereupon the entire family removed to Boston only to find that they had traded the old mare and the vehicle for valuable experience, with nothing to boot. But in January, 1884, the Miller Company came into being, first in a retail store and later as

jobbers. The initial manufacturing operations were carried on in the old Paul Revere house, at North Square, Boston, long before the structure was acquired for historical purposes.

As the business grew, branches were established in Charlestown, Somerville, and Cambridge, and the Charles N. Miller Company was rolling along on high until it encountered the financial depression of 1893. The father, Charles H. Miller, died, two of the sons interested themselves in retail candy stores, and the wholesale manufacturing and jobbing business fell to Charles N. Miller. Then followed a long period of slow development, during which the indebtedness incurred prior to 1893 was paid, but it was during those years that Mr. Miller was building on stable foundations a reputation for honest dealings, which has proved to be of immense value to the present company.

In 1917, Alton L. Miller, older son of Charles N. became a partner, and later, when the company was incorporated he was chosen treasurer and manager.

A nation-wide business in the candy specialty, "Mary Jane," has been developed in the intervening years, and the distribution of this molasses and peanut butter combination has grown by leaps and bounds. So universally known is this product that it is related that when a man, touring in South Carolina, halted his automobile beside a barefooted negro boy and unwrapping a penny bar said, "Sam, you may have this candy if you can name it," the reply came instantaneously, "That's a Mary Jane, boss."

The company's plant at 16-24 Medford Street employs upwards of 150 operatives. Charles N. Miller is president, Carl W. Miller, secretary, and Alton L. Miller, treasurer and general manager. The corporation has capital of \$200,000.

THE BAY STATE BELTING COMPANY

The Bay State Belting Company which has its main office and factory at 349 Congress Street, Boston, was incorporated in 1884 to tan and manufacture belting, and soon afterward purchased the land and wooden buildings, in Salem, in the Blubber Hollow district, now known as 50 Grove Street.

The latter part of 1911 the company increased its capacity by the erection of a separate beamhouse, power plant and three-story building, all of brick of the most modern construction, so that leather could be produced with the least possible labor and under up-to-date conditions.

Oak tanned leather, purchased in the rough, is curried, stretched and finished, while the company's original and genuine India tanned belting and its twentieth century Water King belting are both manufactured from green salted hides. All leather produced at Salem is shipped to the Boston plant, where it is made into the finished product, and from which point it is shipped to the consuming trade.

The corporation has capital of \$300,000, and employs 150 operatives.

Francis P. Blake is president, E. J. Manchester, secretary and Charles S. Frary, treasurer.

THE RIVETT LATHE AND GRINDER CORPORATION

The Rivett Lathe and Grinder Corporation was established at Faneuil, in the Brighton District, in 1884, by Edward Rivett, a skilled mechanical engineer who recognized the necessity of a small accurate lathe with which

the scientist and advanced mechanical worker in any profession could produce the precision parts required for models and demonstration equipment. The Rivett No. 3 bench lathe met with such success that in 1890 the Rivett No. 4 lathe was introduced. Mr. Rivett subsequently developed the Rivett-8" Precision Lathe, the first fine, accurate, back-gearred, screw-cutting apparatus produced. Before 1906 the company had increased its line to include several sizes of grinding machines, a bench miller and a remarkably complete line of attachments for its line of bench lathes. A catalogue published at about this time bears evidence of the extraordinary devotion and mechanical skill of Edward Rivett, and his name became known throughout the world as standing for a degree of precision at that time quite unique in the small machine-tool field.

In 1912 a group of financiers purchased the business and incorporated it as The Rivett Lathe and Grinder Company. Unfortunately, the several managements which succeeded were neither successful in retaining the interest of Edward Rivett, nor of carrying out the progressive policy which he had pursued in directing the business for himself.

In 1915 a substantial addition to the plant was completed and during the war years the company was very active, employing at one time over two hundred men and shipping in one year about \$800,000 worth of machine tools and accessories. In the depression which followed the war, however, when nearly all machine tool manufacturers industriously kept their concerns alive by taking in all manner of job work and straining every nerve to design and produce improved tools, the company suffered through lack of proper diversification. A further addition to the plant doubling its previous capacity was completed in 1920, but the financial condition had become so embarrassing that new management was secured and a voluntary receivership arranged. Complete reorganization and refinancing were undertaken, and in October, 1921, less than a dozen hands were employed.

In May, 1923, The Rivett Lathe and Grinder Corporation took over the assets of the old company. The loyalty of several former stockholders and directors and the confidence in the business on the part of the banks and several large creditors resulted in successful refinancing, and the new corporation brought its various lines of products up to date, but was handicapped by limited funds and innumerable patents on automatic improvements by others and for three or four years the task of reconstruction was slow.

A development of lubrication appliances was commenced in 1922, but not until 1928 was the Blanchard pulsating system for automatic oil lubrication announced. By this time the machine tool and accessory business had begun to show signs of improvement and for the past year the corporation has been rapidly increasing its activity. The first six months of 1929 produced total sales exceeding any previous whole year, except during the war period, and both the Lubrication Division and the Machine Tool Division, are running at full capacity and are giving promise of prosperous days to come.

Thorvald S. Ross is president, Merle E. Johnson, treasurer, and Francis S. Moulton, secretary of the corporation. The main office is at the Brighton plant, and branch offices are operated in New York City, and Detroit, Michigan. The corporation has capital of \$460,000 and employs 250 operatives.

THE NEW ENGLAND ELECTROTYPE COMPANY

The plant of the New England Electrotype Company located at 470 Atlantic Avenue, is the largest and finest equipped in the east, and was founded forty-five years ago by George C. Scott, one of the first local electrotypers, under the name George C. Scott & Sons to make electrotypes from wood cuts and type forms—the halftone as it is known today not having been discovered at that time.

The new concern prospered from the beginning and progressively kept apace with each new step in the industry.

The founder's two sons, Josiah and Willard, were taught the business and upon the death of Geo. C. Scott, they continued his policies of progressiveness.

In its growth it merged four other plants, the American Type Founders Company, the Dickenson Type Founders Company, the Suffolk Electrotype Company and the Bay State Electrotype Company, and the name was changed to the New England Electrotype Company.

The past few years have witnessed many changes. Josiah Scott retired from the business and later died. He had no sons but the three sons of Willard Scott were taught the business after first receiving a thorough schooling in business principles. While Willard Scott is still active in the concern, representatives of the third generation, George C., Chester T. and Whittemore W., are in control of the company's policies.

The volume of business is large and despite slumps in the industry has been steadily increasing, due in large measure to the progressive innovations introduced.

The Claybourn process which eliminates hand straightening and produces electrotypes that require but a minimum of makeready is used on all high-grade work, and the concern was the first electrotype plant in the east to install proof service to customers.

The largest motor and dynamo built for the generation of power for electrotyping was but recently installed. The plant has complete equipment for wax ruling, stereotyping and matrice-making, and every class of electrotyping. Large advertising campaigns are handled and storage racks are arranged for the speedy handling of this class of work.

This plant operates both day and night service, and employs about eighty persons. The sales force covers the entire New England district and New York state and serves the largest territory of any New England plant.

W. W. Scott is president; C. T. Scott, secretary, and George C. Scott, treasurer.

THE SHEPARD & MORSE LUMBER COMPANY

The Shepard & Morse Lumber Company was organized on April 24, 1884, under the laws of Maine, succeeding a Massachusetts corporation, which had been doing business for some five or six years previously. The company was founded by Otis Shepard, who was its manager for a generation. In the earlier years of the company it handled mostly white pine lumber, from Canada and Michigan, and was affiliated with the Saginaw Lumber & Saw Company, of Saginaw, Mich., and it maintained yards at Ottawa, Ontario and Burlington, Vt., as well as a large planing mill, in the latter city.

The corporation still maintains yards in Ottawa and the Burlington mill and a distributing plant there, and is probably the oldest company of any appreciable size doing a lumber business in New England or New York state. All other competing concerns, engaged in white pine distribution have retired from business. About 1918 the Shepard & Morse Lumber Company of Canada, Ltd., was formed to take care of the Canadian trade, but it is entirely owned by the American Company.

At that time it operated a large sawmill at Ottawa, Ontario and another at Gaspé, Que. The latter plant is still owned by the concern, and has a daily capacity of about 115,000 feet of spruce lumber. During the last few years, since the Welland Canal has been enlarged, Pacific Coast lumber has been received by the corporation in large quantities and, in order to prepare to handle its share of that business, the Shepard Steamship Company was formed, which owns three steamships, each of which has a carrying capacity of a little over 5,000,000 feet of rough lumber. The concern operates a regular line of sailings to the Pacific Coast in order to handle its Pacific Coast business and it contemplates adding to the steamship fleet in the near future.

H. B. Shepard is president, T. H. Shepard, treasurer, and M. A. Holbrook, secretary, and the United States headquarters are at 40 Central Street, Boston.

D. C. HEATH AND COMPANY

The house of D. C. Heath and Company, publishers of school and college textbooks, was founded in 1885, by Daniel Collamore Heath. Soon afterwards Charles H. Ames, Dr. William E. Pulsifer and Dr. Winfield S. Smyth became partners in the enterprise. In contrast to the small beginnings of the house in capital and books there stand out in strong relief the character and ability of the four original partners, who shaped the policies of the company. In November, 1895, the partnership was changed to a corporation.

Dr. Pulsifer served as president from 1910 to 1927, and under his able leadership the house maintained its reputation and grew to large proportions, in numbers of titles and volume of business. In addition to the home office, at Boston, there are now sales branch offices in Boston, New York, San Francisco, Chicago, Atlanta, Dallas and London.

The company publishes books in many languages and markets them in practically all countries of the world. A large majority of its publications are manufactured in the vicinity of Boston, under direction of A. J. Burdett, head of the manufacturing department. A. M. Strong is manager of the New England office, and M. B. Perry is treasurer of the corporation. The present directors are W. S. Smyth, president, son of one of the original partners, F. F. Hummel, vice president, D. R. Cowles, secretary, Dr. F. W. Scott, editor-in-chief, and Dr. E. C. Hills. The corporation has authorized capital stock of \$2,000,000.

THE ANDREW DUTTON COMPANY

In 1885 the Andrew Dutton Company was established and is engaged in the manufacture of window shades and awnings, and upholsterers' and bedding supplies. The corporation has capital of \$400,000. Its officers are Frank L. Clifford, president, William C. Belden and Albert F. Conant, vice presidents, Alfred H. Colby, treasurer and general manager, John

R. Davis, assistant treasurer and S. S. Watts, secretary and clerk. Its plant and headquarters are at 60 Canal and 155 Friend streets.

In 1885 the Howard Manufacturing Company was established, and at its Charlestown plant carries on the manufacture of elastic webs and yarns and razor strops. The corporation has capital of \$90,000. W. F. Howard is president, W. J. Hughes, treasurer, and J. Howard Hughes, clerk.

GUSTAVUS F. SWIFT, FOUNDER OF SWIFT & CO., WAS A CAPE CODDER

Gustavus F. Swift, a native of Cape Cod, began at the age of nine years, purchasing chickens from his grandfather and selling them at a profit, a policy which was destined to result in his becoming the pioneer of the peculiarly American idea of shipping dressed beef from a central point in the Middle West to the Atlantic seaboard.

It was at Barnstable, that he learned the butcher business. Leaving school at fourteen years of age young Swift began work for an older brother, then the village butcher, who paid him the munificent wage of a dollar per week.

For two and a half years he observed and studied the methods then in vogue, and borrowing twenty dollars from his father he invested the capital in a heifer, which he killed and dressed without assistance, and marketed the meat to the people of the locality. The ten dollars he made on that transaction formed the nucleus of the business internationally known as Swift & Co., which in a single year amounts to upwards of a billion dollars in sales.

With his original borrowed capital and surplus profits he bought an animal each week, took it to the Brighton abattoir to be slaughtered and sold the meat from house to house. Slowly but surely he accumulated enough money to warrant opening a meat market in the little town of Eastham, on the Cape, during the winter of 1859-1860. Next came another successful retail meat market venture in Sagamore, and a third in Barnstable, each being a larger enterprise than its predecessor.

Mr. Swift saw that buying live stock from Cape Cod farmers offered greater opportunities for profit than the retail meat markets, and turning the latter enterprises over to capable clerks, he at once began to buy and sell cattle in the Watertown and Brighton stock-yards. In order to provide an outlet for the dressed meat he became a pioneer in the chain store plan, for, in addition to his markets on Cape Cod, he established retail stores in Clinton, Lancaster, Taunton and Freetown, each in charge of a capable manager.

In 1872 he became a partner with James A. Hathaway, then one of the leading retail meat dealers of Boston, and at once assumed charge of the purchasing operations of the firm.

It was not long afterwards that he sensed the fact that the center of the livestock industry was steadily but surely moving westward, and that the seaboard cities of the East must rely upon the West for their livestock supplies. Gradually he transferred his buying operations from Boston to Albany, thence to Buffalo, and finally, in 1875, to Chicago. Ere long he saw the possibilities of the refrigerator car, then undergoing the experimental stage in the Windy City. In vain he presented the proposition to his partner, Hathaway, to join him in shipping beef from the metropolis of the West to Boston. Failing in the attempt, he induced

Herbert Barnes to handle his beef in the territory which he had cultivated in Massachusetts, and in 1877 Swift became a Chicago packer and made his first shipment to the East.

The territory adjacent to Boston became his first great market and its acceptance of western beef early assured the success of the enterprise.

But his pathway was not strewn with roses at the outset.

The first hurdle he was obliged to overcome was the refusal of the railroads to build refrigerator cars. Then some of the systems refused to haul them.

Swift surmounted the first obstacle, by constructing the cars at his own expense.

He overcame the second objection by finding a road—the Grand Trunk—then possessing but little livestock traffic, whose officials were anxious to coöperate and secure his tonnage, and were willing to haul his products to the East. Then there arose the strenuous opposition of the eastern stockyards and butchers who saw that their business was being threatened. Inspired propaganda religiously circulated against western beef resulted in the products being boycotted on the theory that they were unwholesome and finally hostile legislation was resorted to in an endeavor to protect the local interests against his policy.

But his antagonists had not counted on the type of man they were fighting. Swift was a typical New Englander, and possessed not only the vision, foresight and business acumen so characteristic of Cape Codders, but that tenacity of purpose and resourcefulness which prompted him to evolve and employ an effective method for breaking down these barriers. He at once entered into partnership with leading butchers in various New England towns and cities, allowing them commissions on the beef sold and dividing with them the accruing profits.

A younger brother, Edward C. Swift, was placed in charge of selling operations in the East, with headquarters in Boston.

Many of his early partners on Cape Cod, who had worked in his markets, or had been associated with him in livestock buying and selling enterprises, were drawn to his side and took a special interest in the success of the new western dressed beef trade.

These partnerships formed the entering wedge that enabled him to wear down the prejudice and opposition, and after the incorporation of his company, in 1885, branch selling houses were established and gradually superseded the partnerships.

In the succeeding years the total has grown until today there are approximately seventy-five branch houses operated by Swift & Co., in New England, all under the jurisdiction of the Boston office.

Naturally, this section was the first invaded by Gustavus F. Swift because of his knowledge of conditions and his long experience in the field of purveying dressed beef to his original chain of retail markets, and following the incorporation of Swift & Co., special attention was given to the New England territory, a policy that has continued to the present. Even remote seashore and mountain resorts are constantly supplied with fresh meats by the Swift branches. While it is undoubtedly true that Swift & Co. leads other packers in the volume and value of sales in New England territory, competition both with large international packing organizations and with local packers is keen, and no one company actually controls the New England market. However, the strong position of Swift

& Co. in this territory is emphasized by the fact that there are more stockholders in the enterprise in Massachusetts than in any state of the Union save Illinois, and it is significant that Swift stock is listed on the Boston Exchange and not on the New York Board.

Six sons of Gustavus F. Swift are associated in the management of the corporation he founded, and one of them, George H. Swift, makes his home in Boston, and supervises the New England business.

The activities of Swift & Co. have kept pace with the growth and development of Metropolitan Boston and of Massachusetts, four branches being located in Boston proper alone and thirty-four in this Commonwealth.

George H. Swift is president and director of various subsidiary corporations engaged in packing and other activities, including the Brighton Stock Yards Company, the Consolidated Rendering Company, the Essex Gelatine Company, John P. Squire & Co., the National Leather Manufacturing Company, the New England Dressed Meat & Wool Company, the North Packing & Provision Company, the St. Paul Tannery, the Sperry & Barnes Company, the Springfield Provision Company, the White, Pevey & Dexter Company, and he is chairman of the board of directors of the Winchester Tannery Company, the A. C. Lawrence Leather Company, the National Leather Company, and the National Calfskin Company.

THE MOXIE COMPANY OF AMERICA

For forty-five years no Massachusetts or New England beverage has been more universally known than "Moxie," which was originally produced in Lowell, but which through the progressiveness of Frank M. Archer, Sr., and his son, Frank M. Archer, Jr., has attained new heights of production and distribution within the past ten years.

In many respects the Moxie Company of America is one of the most original and unique industrial developments in this country, as its product differs widely from that of most beverage manufacturers, and its success has been exclusively in the hands of New Englanders since the trade-mark was registered in 1885.

Not a little of its prominence in the manufacturing field has been due to judicious advertising and to improved machinery, as well as to the application of modern business ideas.

One of the recent innovations flowing from the versatile brain of Frank M. Archer, Sr., was the founding of "Moxieland," which is bounded by three streets and a city square, in Boston, covering a "flat-iron" space of 85,000 square feet, located just a step from the Fenway, and the Boston Art Museum, and designed to be not only the last word in up-to-date production facilities, but a civic center, and a place where people can congregate and enjoy themselves. Although situated in the very heart of Boston, "Moxieland" is graced by a flower-filled park with walks, shaded benches, a refreshment booth, and a bandstand. There is a Toytown for the little folks, to whom every day is Christmas, for not only is its progenitor known as the "playboy of the advertising world," but also as "New England's champion of children."

For more than twenty years Mr. Archer never failed to supply more than his share of trucks and cars to carry 2,000 youngsters to Nantasket Beach for the annual outing of the crippled, orphaned and destitute children of Boston, and one day not so many years ago for the first time in

forty years not a case of his product was delivered in the Hub, in order that 3,000 little folks might participate in the festivities down Boston Harbor. On another occasion, when a big elimination marble tournament was under way, in Boston, Frank Archer surprised the management by appearing with 100,000 marbles for the entrants.

In practically every New England city where daily newspapers are published, he has paid his tribute to the newsboys because he likes their initiative and the manner in which they serve their customers, in spite of storms and freezing weather. He has provided them with carloads of carts, which he terms "pullmobiles," countless wheelbarrows, which he denominates "pushmobiles," and thousands of sleds for use in the winter seasons.

It has been said that nobody ever saw his advertising on anything that was otherwise utterly useless. He employs the newspapers for advertising because he believes them to be as much a part of daily life in every household as pure food and drink, but he gives away annually hundreds of thousands of "candymen"—lollypops incased in glassine paper, upon which his message is printed, and countless toy reproductions of his famous Moxie horsemobiles.

A part of every year he donates the use of the white horse mounted on the automobile chassis and the jockey-chauffeur to the U. S. Army in its recruiting work, and in the New England towns the equipage and the service of the drivers are placed at the disposal of charitable organizations.

Not long ago when radio was more of a novelty, Frank Archer had replicas made of the famous horsemobile in the form of crystal radio sets, with headphones mounted on the automobile chassis. These Billy B. Van, the actor, offered to shuttles night after night in the course of his radio talks. Several thousands were placed in the homes of people who could not afford more powerful sets and who were confined to their homes.

Mr. Archer has made his method of doing big business as playful and human as it is practical. When he contemplates advertisements in college magazines and papers, he affords the students a chance to gain practical experience by submitting to him the layouts to be used in their own magazines, and pays each artist and writer for those worthy of publication.

The Department de Cuisine in "Moxieland" originates and tests new desserts and drinks in which the beverage plays the chief part, but the real show place is the white enamel-walled and tile-floored department where bottles are cleansed, sterilized and filled by special machinery. The assembling tables, automatic carriers, fillers and cappers, labeling machines and delivery runways are the most efficient that the company's years of study and experience can provide.

From the department where every ingredient that goes into Moxie is proved to be up to the standard, to the assembling department where the materials are blended in great glass tanks, the processes are visible to the visitor.

Two artesian wells produce an unlimited supply of pure water, and the refrigerating and ice systems have a greater capacity than that of any Boston ice plant. The main building has shipping facilities for the assembling of ninety car loads of the product at one time. The company maintains an overnight service between "Moxieland" in Boston and its distrib-

uting station in New York, which makes immediate delivery certain to all parts of the greater city.

All his life an advocate of pure food, Mr. Archer has associated himself with many of the leading pure-food experts in the country and has found time to help devise more perfect machinery for packaging food products.

The corporation has capital of \$500,000 and employs upwards of 150 operatives. F. E. Thompson is president, Frank M. Archer, vice president, and H. A. Thompson, treasurer.

THE CLIFTON MANUFACTURING COMPANY

The Clifton Manufacturing Company traces its genesis to the old Cable Rubber Company, which was operated for many years, in a small plant on Brookside Avenue, Jamaica Plain. In 1887, Miss Amanda M. Lougee and Samuel Williams founded the Clifton Manufacturing Company, which was incorporated fourteen years later, with capital of \$25,000. William M. Tenney became interested in the enterprise, purchased Miss Lougee's interests, in 1903, and assumed the active management of the concern. Upon his death in August, 1924, his son, Frank C. Tenney, became president.

N. Lincoln Greene, formerly general manager of the clothing division of the United States Rubber Company, became associated with the corporation, in 1922, and now holds the positions of vice president and general manager, having been the active executive of the concern since the death of William M. Tenney. Donald B. Webster, secretary and treasurer, formerly with the United States Rubber Company, and with C. F. Rittenhouse of Boston, auditors, has been with the company since 1927, succeeding H. G. Morse, who resigned the position of treasurer. C. E. Bufum is assistant treasurer.

In April, 1926, the business was reincorporated under Massachusetts laws. The company has always been noted for its high quality rubber clothing, which is its oldest line of production. Other commodities include friction tape and splicing for the electrical trade; coated gem duck for shoe factories, with a complete line of backing cloth and shoe tapes recently added; rubberized fabrics for the cutting trade; and miscellaneous rubber goods such as blankets, ponchos, aprons, and protective covers.

Its sales have grown from approximately \$100,000 a year to more than \$1,000,000 per annum, and with this development, the floor space has been increased by the addition of new buildings from time to time, until now about 50,000 square feet are occupied, a new building for the office and to provide additional production space, having been erected in 1920, and a new mill room built in 1926.

The employees number 200, and the market for the company's products is gradually being extended to foreign countries. The main plant is at 65 Brookside Avenue, Jamaica Plain, and a branch is operated at 68 Essex Street, Boston.

THE MODERN PRISCILLA

In March, 1887, T. E. Parker of Lynn, issued a limited edition of a few thousand copies of a new magazine entitled *The Priscilla*, which was mailed to a list of women who were on his records as purchasers of fancy goods, and many of whom comprised the first subscribers.

The publication contained ten pages; the subscription price was 50

cents a year; and the purpose, in the words of the owner, was to make "a magazine for ladies' work and ladies' pleasure." Isaiah C. Parrott, under the pen name of Mrs. Beulah Kellogg, was the first editor.

Mr. Parker continued to publish the magazine from 1887 to 1893, when its subscription list had grown to something less than 10,000. In February, 1893, the publication was purchased by W. N. Hartshorn and moved from Lynn to Boston, and its name was changed to *The Modern Priscilla*, having in mind Priscilla Alden as a namesake, because of her loveliness of person and disposition as the wife of John Alden and their ideal partnership, the story of which has never failed to charm since Puritan days.

From a twenty-page publication, having a subscription of 10,000 copies a month in 1893, Mr. Hartshorn had brought its circulation to 122,000 copies by 1905.

In 1906, as a particular service and protection to subscribers, the magazine introduced a guarantee, protecting every reader against loss in dealing with its advertisers which inspired a confidence in the products exploited in its columns and at the same time created a positive belief in the standards of the publication. If any advertiser failed to adjust a legitimate complaint, then the magazine righted the wrong, and at the same time, severed connections with that firm and refused it entrance to the magazine again. This guarantee has been faithfully maintained ever since its inception and is a protection which its subscribers have sincerely appreciated.

In 1907, the Priscilla Publishing Company was incorporated, with W. N. Hartshorn as president, and the February, 1912, issue was its twenty-fifth anniversary number. In contrast to its first issues, it contained sixty pages, and its circulation was 300,000 a month.

Effective with the March, 1912, issue The Priscilla Publishing Company, Inc. combined its own publication with *Everyday Housekeeping*, which it purchased outright, and effected a combination which gave the best in fancy work and housekeeping, in all their phases, thus completing an ideal union. The November, 1912, issue, embracing all of these improvements, contained eighty pages.

Modern Priscilla's circulation grew steadily: in 1914, it was 400,000; the next year, one-half a million monthly, and it has been consistently maintained at well over the 600,000 mark ever since. In 1917, *Modern Priscilla* absorbed the *Home Needlework Magazine*, and that year a unique plan was put into effect in connection with the Housekeeping Department, whereby a modern, attractive, livable house, located in Somerville was endowed with the title, "Modern Priscilla Proving Plant." In this dwelling were installed a regular family, consisting of a housekeeping editor, her husband and her children, together with a staff trained in home economics, tempered by a representative amount of "ordinary" household management and the presence of unskilled labor, for the purpose of learning the possibilities of misuse of or deficiency of any product, article or device, thus making for absolutely complete understanding of everything sent to the Proving Plant for a test, not only under actual home conditions, but under chemical test or mechanical inspection by one of the professors at the Massachusetts Institute of Technology.

Food products of all kinds are constantly being sent to the Priscilla

Proving Plant. To determine purity, each is tested by the Staff Chemist, who is a member of the faculty of the Massachusetts Institute of Technology. To determine the practical value and usefulness to the satisfaction of the housewife, each product under test is used in the preparation of food served on the Proving Plant family table. From day to day, the members of the family and the staff pass judgment on the results. Only in the event that these and the chemical analysis are favorable is the product awarded a certificate of approval and is permitted to use the insignia which denotes approval by the Priscilla Proving Plant. Because of the great amount of food which is constantly being tested at the Proving Plant, the choicest recipes are available and these are given editorially to the housewife so that she is constantly kept informed of what is best in foods and food combinations.

The Priscilla Proving Plant was later moved from Somerville to Newton Center. A department which is of special interest is the Priscilla Nursery. In addition to editorial material by child specialists of eminence, a practical report of what transpires in the nursery of the Priscilla children has much value and serves a specific need. Interior decoration is also given special attention at the Proving Plant.

This charming home, which represents the homes and home needs of 600,000 *Priscilla* readers is built on a foundation of service. Its staff corresponds regularly with thousands of its subscriber-friends, suggesting a color combination for the living room, rearrangement of the furniture in the dining room, and how to "do over" old possessions to make them look like new. These and thousands of other questions are painstakingly answered and an intimacy developed with the readers of the magazine.

In 1926, *Priscilla* moved to new quarters in the Harbor Building. The magazine is now finely dressed in attractive, readable type, with engaging covers. It has grown up from a lean little girl, forever plying her needle and thread, to a charming woman, caring for home, husband and children, sewing, decorating, cooking; keeping a real home, retaining what is best of the "old-fashioned" ideals, and absorbing the many advantages of modernity. The officers of the Priscilla Company are Arthur J. Crockett, president and treasurer, and Fred Mozley, business manager. The corporation has a capital of \$210,000 and employs 200 hands.

THE SAGER ELECTRICAL SUPPLY COMPANY.

The Sager Electrical Supply Company was organized in 1887 by James W. Poole, who operated a small factory on Atlantic Avenue, where he manufactured speaking tubes, bells, and other sundries used by electricians and bell hangers at that time. In 1903 the concern moved to 16 Columbia Street, and added electrical supplies, which it did not manufacture.

In 1912 the company was incorporated and three years later abandoned the factory on the top floor of the structure it occupied.

In 1909, James E. Sager became identified with the company as salesman, and seven years later was chosen as treasurer and manager. In 1920 the firm moved to 201 Congress Street, and that year the name was changed to The Sager Electrical Supply Company. Ten stores are now operated in Massachusetts.

THE BOSTON BANK NOTE COMPANY

In April, 1887, the Boston Bank Note and Lithographing Company was established on the second floor, at 49 Franklin Street, and ten years later its president, G. P. Johnson, acquired all the stock and organized the Boston Bank Note Company, removing the plant to 148 Pearl Street in 1901, where two Hoe flat-bed presses were added to the equipment. Six years later the company installed one of the first Harris offset presses sold in Boston, and in 1909 larger quarters were secured at 77 Washington Street North.

Three years later the concern was reincorporated and that year additional offset presses of a large size for color work were added to the equipment. In 1925 the company began the erection of its own plant at 141 West Second Street, which was occupied in May of the following year, and which afforded double the capacity at its previous location. Much additional equipment was installed, enabling the concern to carry on all work under its own roof.

The company's specialties are lithograph stationery, diplomas, bonds, stock certificates, checks, lithographed labels and advertising matter of every description.

George P. Johnson is president, Charles T. Gilbert, secretary, and Howard A. Johnson, treasurer, and the company employs fifty operatives.

THE C. S. BINNER CORPORATION

The C. S. Binner Corporation, specialists in manifold and loose leaf systems, has been in business since 1888, although the present management did not assume control until 1915.

Because of increasing business and lack of space it moved from 157 Pearl Street to 217 Friend Street, its present location, in 1919.

Experienced craftsmen are employed in the ruling, composition, press-work and binding departments, and all operations are carried on under one roof. Its success has been due largely to its efforts to give to customers the best in workmanship and service at all times.

A. E. Gregg is president and treasurer, and Benjamin Phillips, secretary and plant superintendent. Thirty-five hands are employed.

ALLYN & BACON

On July 2, 1888, John Allyn, a Boston publisher, and a native of Belfast, Me., and George A. Bacon, who was born in Webster, formed a partnership for the purpose of publishing high school and college textbooks.

Mr. Allyn had been a publisher since 1870 and on his list were many standard textbooks in Greek and Latin, dating back to the early fifties, most of them the work of New England college professors. These were acquired by him from the list of Sever and Francis of Cambridge, who had their offices in Harvard Square. Mr. Allyn was also an importer and dealer in classical books, notably the well known *Bibliotheca Classica* and the *Weale Series*.

Dr. Bacon, at that time principal of the Syracuse High School, was well known to schoolmasters throughout the United States as the publisher of *The Academy*, a journal of secondary education, which began as the official organ of the Associated Academic Principals of the State of New York, of which Dr. Bacon was one of the organizers.

The new firm transacted its business in a little room at 30 Franklin Street, but after eight months moved to larger quarters at 364 Washington Street. The organization at first comprised three people, Mr. Allyn, editor and publisher, Dr. Bacon, educational expert and sales force, and an assistant who was accountant and shipper. At the outset Dr. Bacon was able to secure by purchase the rights to Walker's Physiology. The other leader was an edition of Caesar's Commentaries, with colored maps and plans, a novel feature in those days, by Professor Kelsey of Lake Forest College and later of the University of Michigan, which had been published in 1886 by Mr. Allyn.

In 1889 the force was joined by Charles E. Bacon, who acted as shipper, and when he returned to school that autumn he was replaced by Paul V. Bacon.

The business grew rapidly and in 1894 a branch was established in Chicago. Dr. Bacon took up his headquarters there, while Mr. Allyn carried on as editor and manager in Boston, where the office had moved again, this time to 172 Tremont Street where it remained until 1914.

In 1896 the Chicago office had added a number of agents to the force, including Charles E. Bacon who, after leaving the business to go to college, returned first as shipper in Chicago and later as agent in Michigan, Illinois, and successively in the other states of the West and South. In 1897 Paul V. Bacon became agent for Wisconsin and later for Illinois.

A New York branch was established in 1898. In 1906 Charles E. Bacon left Chicago for the Boston office, where in 1914 he became general manager of the firm, and in 1913 Paul V. Bacon came to Boston from Chicago, where he took up editorial work, becoming editor-in-chief in 1914. Both joined the firm in 1919.

An office in Atlanta was opened in 1918, and another in San Francisco, in 1920.

The firm employs 250 men and women and since 1914 the Boston headquarters have been located at 50 Beacon Street.

OTTO J. PIEHLER, INC.

In 1888 the firm of Ellsworth & Piehler was established as manufacturing furriers, the partnership being dissolved two years later when Otto J. Piehler became the sole owner of the business. In 1907 Otto J. Piehler, Inc., was incorporated, Mr. Piehler serving as its president and treasurer until his death, in 1928.

In 1920, his son, Edgar V. Piehler, became vice president, and has been the head of the enterprise in that position since 1928. The presidency is held in an honorary capacity by Mrs. Otto J. Piehler. Edgar V. Piehler is also treasurer.

In 1888 to 1898 the enterprise was located at 12 Bromfield Street, but from the latter year until 1908 operations were carried on at 127 Tremont Street. From 1908 to 1924 the concern was located at 356 Boylston Street, but for the past six years the headquarters have been at 407 Boylston Street.

For forty-two years the concern has catered to an exclusive clientele, not only manufacturing for its own retail department, but also for other customers.

THE M'KENNEY & WATERBURY CO.

In 1888, The McKenney & Waterbury Co., Inc., succeeded the firm of C. H. McKenney & Co., which was established by C. H. McKenney at the corner of Congress and Franklin streets, when one floor and the basement were occupied, and when seven persons constituted the working force. Twenty-five years after the formation of the McKenney & Waterbury Co., Inc., the corporation occupied thirteen floors, and employed 160 persons.

In the early days the enterprise specialized in kerosene and gas fixtures, but with the advent of the electrical age practically nothing but electric fixtures have been manufactured and marketed by it.

In 1929, William A. McKenney who had been identified with the corporation and the predecessor firm for fifty-two years retired from the presidency. The corporation has capital of \$400,000.

THE AMERICAN MOISTENING COMPANY

It was in 1888 that the American Moistening Company began the manufacture of its humidifying systems, which proved to be one of the greatest boons the textile industry had enjoyed up to that period.

Many textile plants found it almost physically impossible to produce satisfactory fabrics unless atmospheric conditions were normal, but following the introduction of the artificial methods devised by this corporation these difficulties were overcome.

The corporation employs 150 operatives in its Causeway Street plant and has capital of \$250,000. Russell Grinnell is president, W. M. Trafton, vice president, Edgar Shaw, secretary, and L. W. Jones, treasurer, of the company.

THE BUTTS & ORDWAY CO.

In 1888 Frederic H. Butts and Henry C. Ordway founded the business today carried on by the Butts & Ordway Co., and began operations in a small store on Pearl Street, later removing to 500 Atlantic Avenue, and in 1898, to 190 High Street. From there the concern removed to 33 Purchase Street, in 1906, and added a warehouse in Roxbury, in 1919. Three years later a branch store was opened near Fenway Park which was later consolidated with the main store and plant at 44 Stanhope Street.

In 1898 the concern was incorporated to carry on a wholesale jobbing business in iron and steel, bolts, nuts, and heavy hardware, but to these lines have since been added machinists supplies and automotive equipment. Throughout its many years of growth the old reliable members of the organization have remained to school and develop the newer men. Shortly after the death of Frederic H. Butts, in 1923, his son, F. Marsena Butts, who had been his assistant and sales and department manager, was elected president and general manager, having charge of merchandising and store operation. Chester C. Butts was chosen treasurer, and William J. Flett, vice president and assistant treasurer. The only member of the firm who was one of the original incorporators, is James F. Higgins, who is clerk of the corporation. The concern has capital of \$120,000 and employs fifty operatives.

TRIMONT MANUFACTURING COMPANY, INC.

In 1888, the late Edward O. Ely, and three brothers founded the Trimont Manufacturing Company, locating the original plant in the corner of the extensive acreage now owned by the corporation. For upwards of a quarter of a century, the quartet of brothers remained actively interested in the growth of the concern, the last survivor, Charles C. Ely, dying in June, 1928.

The original product was the Trimo pipe wrench, a tool which has been steadily improved until it occupies an important place in the world market. Next came the Trimo pipe cutter, the Trimo chain wrench, the Trimo monkey wrench, and the Trimo basin wrench.

With the advent of the World War, the company added to its equipment and carried on a vast amount of government work, and after the conclusion of hostilities extended its line in order to use the enlarged plant facilities, and invented and placed upon the market the Trimo pipe vise, which has become a staple article. In 1929 Stillson wrenches, under the trade names of Trimo Sando and Trimo Morocco popular Stillsons were added, when the corporation purchased the wrench business of the Moore Drop Forging Company of Springfield.

At the main office and factory, 55-71 Amory Street, Roxbury, upwards of 300 operatives are employed. Wilmot M. Patterson is vice president and acting president, and William T. H. Salter, is acting assistant treasurer.

Today, the corporation stands as a monument to the memory of the Messrs. Ely, and its field of distribution is world-wide.

STONE & WEBSTER, INC.

In 1889 two graduates of the Massachusetts Institute of Technology, Messrs. Charles A. Stone and Edwin S. Webster, both born and reared in this Commonwealth, formed a partnership, with a capital of \$2,000, and entered the electrical engineering field.

They, like so many others, were told that the field was well filled and that the cream had been skimmed from the electrical milk supply, but undaunted they charted a course which in the intervening fifty years has enabled the concern to take its place as the largest organization of its kind on the globe, and the interesting feature of its activities and world-wide ramifications is that up to 1929 no other foundation capital had been added to the original \$2,000, but it had been financed entirely out of earnings, except for such syndications as had been required in the course of its financial negotiations.

In the fifty years it has constructed steam and hydro-plastic stations producing electricity equivalent to 4,000,000 horse-power, with the total cost of construction amounting to more than \$1,000,000,000, having a total appraisal value today of \$6,800,000,000, while sixty-two public utility corporations in and out of the United States, with a total capitalization of \$400,000,000, are under its executive management, and whose total annual gross earnings aggregate \$80,500,000.

Stone & Webster, Inc., has from the beginning of its existence carried on very large construction and engineering activities, and had on December 31, 1927, projects under construction amounting to \$121,000,000. Its great work today is in the fields of operating public utilities and invest-

ment banking, having recently enlarged the latter by consolidating with an old established Boston house in 1926, this new corporate entity being known as Stone & Webster and Blodgett, Inc.

Incidentally, Stone & Webster, Inc., owns and operates the largest single shaft coal mine in the world, which has a production record of 13,500 tons in eight hours. In 1928, the Stone & Webster Engineering Corporation acquired the engineering and construction business of Stone & Webster, Inc., together with a substantial interest in the construction and financing business of Ulen and Company, which primarily operated in foreign fields. In 1929 the engineering and construction business of McClellan & Junkersfeld was acquired from the North American Company by the Stone & Webster Engineering Corporation.

Such is the record of what two Massachusetts-bred engineers have accomplished on a capital of \$2,000. The power stations erected by the concern represent about 10% of the installed central station capacity of the United States, and supply 20,000,000 persons with electric light and power.

In 1929 the corporation which was formed in 1920 to succeed the original partnership added \$57,500,000 of capital funds and permitted a broad public participation in its extensive enterprise, thus affording a substantial public enterprise in a \$100,000,000 corporation, but with the management unchanged.

At the same time, the large stockholders, who had been responsible for the success of the business, and their associates, increased their capital holdings to the extent of \$17,500,000.

Following are the companies, the majority of all the stock of which is owned by Stone & Webster, Inc.: Stone & Webster Engineering Corporation; Stone & Webster and Blodgett, Inc.; Stone & Webster Service Corporation; Stone & Webster Associates Corporation; Stone & Webster Investment Corporation, and Stone & Webster Realty Corporation.

The investment securities business as carried on by Stone & Webster and Blodgett, Inc., has developed into one of the largest investment securities houses in the country. It originates and underwrites security issues and distributes them both at wholesale and retail, dealing not only in domestic and foreign government, municipal and corporation bonds, but also in preferred and common stocks of railroad, utility, industrial and other companies.

The operations of public service companies in the United States, Canada and the West Indies are supervised in developing proper and uniform accounting, sound engineering, economical financing, the benefits of large scale purchasing, systematic corporate records and compilation and study of accurate statistics of operation.

In addition to Charles A. Stone, chairman of the board, and Edwin S. Webster, president, the directorate of Stone & Webster, Inc.; also includes the following who have long been identified with the business; Henry G. Bradlee, vice president and treasurer, Stone & Webster, Inc.; Henry B. Sawyer, vice president, Stone & Webster, Inc.; F. Higginson Cabot, Jr., also president of Stone & Webster Associates Corporation; Harry H. Hunt, also president of Stone & Webster Service Corporation; George O. Muhlfeld, also president of Stone & Webster Engineering Corporation; Bayard F. Pope, also president of Stone & Webster and Blodgett, Inc.; Edwin S. Webster, Jr., also president of Stone & Webster In-

vestment Corporation; W. Cameron Forbes, former governor general of the Philippines; Joseph P. Grace, chairman of the board of W. R. Grace & Co.; Herbert L. Pratt, chairman of the board, Standard Oil Company of New York; Eliot Wadsworth, formerly assistant secretary of the treasury; Albert H. Wiggin, chairman of the board of the Chase National Bank, and Russell Robb and Whitney Stone.

THE BECKWITH ELEVATOR COMPANY

In 1889 Nelson Beckwith was granted a patent on an automatic elevator gate opening device, and founded the Beckwith Elevator Company, beginning operations in a modest way on Berkeley Street.

His product proved very successful and was shipped to all parts of the United States and abroad, and in 1899 the business was removed to 123 Pearl Street, where two entire floors were occupied, and where also a general line of elevator manufacture and elevator repair work was added.

In 1917 the company was incorporated, and on May 1, 1928, the plant was removed to its present location, at 113 Albany Street, where the street floor of the building is occupied, about twenty hands being employed. The corporation manufactures and installs electric, hydraulic and hand-power types of elevators, ash and invalid lifts, and all kinds of dumb-waiters, specializing on the latter. It carries all kinds of elevator accessories and services and repairs all types of elevators. Mr. Beckwith, the founder, died in 1917, and the business is still owned and controlled by his widow. The present treasurer and manager is H. E. Bedford, who has been with the company since 1913 and who has been manager since 1917. C. P. Beckwith is president.

THE W. S. QUINBY COMPANY

The rise of W. S. Quinby to the presidency of the tea and coffee concern which bears his name, is attended by all the glamour of a Horatio Alger hero. Coming to Boston, in 1881, from Northfield, Vt., he became office boy for a dairy company, next a salesman for the same concern, and, in 1889, with meager capital he launched The W. S. Quinby Company with B. G. Leahy, as a partner, and at the dawn of the twentieth century added tea and coffee products to the sales line. In 1908, a branch plant was established in Chicago, to serve as the base of the Middle West sales force, and nine years later the concern moved to its present large plant, on Atlantic Avenue. In 1924, the company opened its third plant, this time in New York, and, in 1927, another in Philadelphia. In 1929, the company extended its field of distribution to the Southeast, when it established another roasting plant, at Jacksonville, Fla., which serves the states of Florida, Georgia, North and South Carolina, Alabama and Tennessee.

In addition to being a successful manufacturer and distributor, Mr. Quinby took rank during his life as one of Boston's modest philanthropists, his generosity in providing \$12,000 to the Boston Symphony Orchestra making it possible, in 1926, for this organization to broadcast a series of concerts over the radio for a period of twelve weeks.

As a result of research, the company developed a new product in 1928 a type of coffee flavor for confectionery and ice cream. The new flavor is marketed in two forms, a concentrate for candy and a syrup for ice cream, both of which have been adopted by leading manufacturers.

The original research was undertaken with a two-fold purpose, to

check up certain ideas on waste recovery that were in the minds of the company's officers, and to see what technical research might do for the coffee roaster. As often happens in research programs, new leads developed that proved more valuable than the first objective. The research work was done by Arthur D. Little, Inc., of Cambridge.

The corporation has capital of \$1,000,000 and employs 150 operatives, the Boston plant being at 291 Atlantic Avenue. Warner V. Taylor is president, Elmer E. French, secretary, and Austin G. Bourne, treasurer, of the company.

THE W. J. FALLON LEATHER COMPANY

In 1889 W. J. Fallon, Sr., founded the present W. J. Fallon Leather Company, at 52 Purchase Street, later removing to larger quarters located on the terrain where now stands the South Station. From there the company went to Dorchester Avenue, in connection with Messrs. Stiles and Winslow, and as the business developed it removed to the present commodious quarters at 23-24 Norfolk Avenue, in 1899, where upwards of 50,000 square feet of area are occupied.

In 1918 the company was incorporated, with capital of \$200,000, the founder becoming president and treasurer. The concern manufactures Goodyear and McKay welting and waist belt leathers, and employs upwards of eighty operatives.

W. J. Fallon is president, vice president and treasurer, James E. Fallon, assistant treasurer, and Harry G. Fallon, secretary.

From 1880 to 1890 John B. Lewis, a native of Wilmington, with sales headquarters in Boston, operated large shoe factories in Abington, Avon, Brockton and Randolph, and is said to have sold directly to the retail trade, during that period, more shoes than any other Boston manufacturer of that decade.

H. S. & M. W. SNYDER, INC.

In 1889 Harry S. and Moses W. Snyder established the Bay State Leather Remnant Company of Haverhill, which continued in operation until 1911. In 1909 they purchased the factory of Emory & Marshall, shoe manufacturers, the plant of the Andrews & Woods Bottling Co., and that of the Haverhill Tack Company, as well as the power plant which furnished power and heat to Phoenix Row, in the Haverhill shoe district and established the Bay State Leather Company, and in 1912 they also fostered the City Tanning Company of Salem.

In 1914 they formed the H. S. & M. W. Snyder Co., which they incorporated three years later, with Harry S. Snyder as president and Moses W. Snyder as treasurer.

The corporation has capital of \$600,000 and employs 150 operatives in its Peabody factory and at the Boston office at 65 South Street.

THE TUTTLE SILVER COMPANY, INC.

In 1890 the Tuttle Silver Company was established by the late T. Frank Tuttle, to specialize in repairing old silver, the original concern being known as the T. F. Tuttle Silver Company. Following his death about 1907 the enterprise was acquired by a corporate group, headed by Bernard A. Dolan, who had been long in Mr. Tuttle's employ, and in 1911

the Tuttle Silver Company was incorporated with capital of \$8,100 which has never been increased, although today the concern has a surplus of more than \$100,000.

The original small workshop was supplanted by a large studio at 107 West Canton Street, with offices there and at 21 Bromfield Street. About seventy men are employed, many of the number being skilled workmen who hammer the flat silver into period products of early American, English and Dutch reproductions, for which the company has become famous.

For many years the Pine Tree shilling has been the company's registered trade-mark and as the silver is made to last for generations, it was thought advisable to have the pieces date-marked so that in years to come the exact time of their manufacture could be ascertained. Mr. Dolan took the matter up with President Coolidge and obtained permission to use his initials and Roman numerals to designate the year of his administration in which each piece was made. This method of dating the silverware will continue and all ware made since March of 1929, bears the initials H. H. and the numeral 1, signifying the piece so marked was made the first year of Herbert Hoover's administration.

Up to the time Mr. Dolan assumed charge of the company's affairs, the concern was unknown outside of Boston, but today Tuttle silver is handled by exclusive jewelers in each important city of the United States. He has given to the trade such beautiful patterns in sterling silver as the Paul Revere, the Georgian, the Early American and the Dublin or Irish in hollowware, the Onslow and Paul Lamerie in flatware and many odd, interesting pieces adapted from the works of former craftsmen.

The Tuttle Silver Company follows closely the footsteps of the old masters. Each piece created is an artistic achievement and one that retains its charm of design, as well as its perfection of workmanship.

Bernard A. Dolan is president and treasurer of the corporation.

A PROGRESSIVE TEXTILE AND ENGINEERING CONCERN

While Boston has never been exclusively a textile center, here are located many of the headquarters of the leading cotton, woolen and worsted concerns, whose plants are situated in the leading textile cities and towns of New England. Among the leaders is Lockwood, Greene & Co., managers of plants in Massachusetts and other parts of New England, employing many thousand operatives.

Early in 1890, a firm of industrial engineers previously located in Providence, R. I., opened its office in the Rialto Building, on Devonshire Street, Boston, on the site now occupied by the New England Trust Company. It carried on a business which had been in continuous existence since 1832, when David Whitman began as a pioneer in mill engineering. Amos D. Lockwood succeeded him in 1858, and, in 1862, Stephen Greene became a partner with Mr. Lockwood and the business has since been carried on under the name of Lockwood, Greene & Co. Continuing from 1890, an engineering organization was developed which has served clients in all parts of the country and, while specializing in the textile field, its prestige has been carried far into other industries as well.

The first partners in the business were cotton manufacturers and they early established a reputation in mill management. Later partners com-

ing into the concern also brought ability of the same kind from their previous connections with textile concerns so that a natural development of the business included textile management as well as industrial engineering.

Edwin Farnham Greene, became treasurer of the Dwight Manufacturing Company in 1905 and treasurer of the Pacific Mills, in 1907. S. Harold Greene became treasurer of the Lawton Mills Corporation in 1908. In 1913, the Lancaster Mills of Clinton, long an engineering client, retained Lockwood, Greene & Co. as managers and in the same year the organization accepted the management of the International Cotton Mills, which, in 1923, became the New England Southern Mills. Winsboro Mills followed in 1916 and in 1919 the Roxbury Carpet Company of Saxonville entered into an agreement for management along with the others. By that year the mills under Lockwood, Greene & Cos'. leadership produced a great variety of textiles all the way from the lightest weight fine goods to carpets, including also sheetings, gingham, cotton dress goods, crash, duck, paper felts and tire fabrics. Approximately half of the spindles under the direction of this management organization are located in the southern states and the remainder in New England and Canada.

In 1890 the Hub Hosiery Mills were incorporated, with capital of \$95,000 to manufacture infants' worsted, cotton and silk stockings. The plant was equipped with complete dyeing and bleaching departments, and the growth of the concern necessitated the purchase and operation of another plant, in Lowell, a few years ago. In 1929 all manufacturing operations were transferred to the latter city, where the company employs upwards of 650 operatives.

Charles G. Squibb is president, Philip L. Reed, treasurer, and H. Jaques, vice president.

THE JAMES H. PRINCE PAINT COMPANY

In the spring of 1890 James H. Prince founded the James H. Prince Paint Company to manufacture ready-mixed and paste paints. He was closely connected with the lead trade, having been identified with the Eagle and other lead companies, for many years.

An office was opened at 161 Milk Street and a factory at 150 Portland Street, and operations were carried on at these locations until 1895, at which time the building at 5-7 Lancaster Street was leased. This structure consisted of five stories, the first floor being used for a shipping room and office, and the remaining four for manufacturing purposes.

The company continues to operate at the same address, although the founder and the original officers, Messrs. Edward Stanley, Charles H. Seaward and Luther N. Johnson have died.

The present officers are president, D. C. Arnold; secretary, R. H. Everett; treasurer, H. F. Forster; assistant treasurer, Miss G. M. Twomey.

Some of the well-known products of the company which have been on the market for thirty-nine years are Derby ready-mixed house paint, Super colors in oil, Concord wagon paint, and Prince floor and deck paints.

For more than thirty years the company has been the New England agent of the Keystone Varnish Company, manufacturers of Keystone; Degrah, a waterproof spar, and Edelvice enamel. The corporation has capital of \$50,000.

THE THOMAS G. PLANT SHOE CORPORATION

Thomas G. Plant founded the shoe manufacturing concern which to-day bears his name, when he began business in a small factory, in Bath, Me. Ambitious for larger opportunities, he removed to Lynn, where, in 1891, he formed the Thomas G. Plant Company, which two years later was incorporated as the Thomas G. Plant Company, with \$150,000 capital. In July, 1927, the business was reincorporated as the Thomas G. Plant Corporation, under which designation it operates today. That year the factory was removed to the Jamaica Plain district of Boston.

In the thirty-eight years of its activities it has attained an international reputation, and it today ranks as one of the outstanding footwear concerns in the world. Housed in one of the most modern shoe plants, the eight separate structures, erected in the form of a hollow square, each having a uniform width of fifty-five feet, and all connected with each other, represent a total floor area of thirteen acres, and a total length, if each building were placed end to end, of seven-eighths of a mile. The structures are lighted by 2,039 windows, and the three entrances to the factory proper communicate with five large fireproof stair towers of steel and concrete. The roofs of the structures are of saw-tooth skylight construction with a northern exposure, thus insuring a soft, clear light, and all the workrooms are painted with enamel gloss finish, which contributes to sanitary conditions.

In designing the buildings attention was given to a system of ventilation, by which the air is changed every three minutes through the medium of fifty-three fans and blowers, which require 350-horse-power in their operation, and to insure an equalized temperature during the winter season upwards of seventy thermometers and hygrometers are located in the factory, to regulate both temperature and humidity. The buildings are heated and ventilated by the direct air circulation system. Every department is connected through a central telephone system, not only with the outside world, but with every unit in the plant, this service requiring sixty-three individual phones, eight trunk lines and three telephone operators.

The company's facilities for rapid and efficient production are unsurpassed. It operates its own printing department, its own last and wood "heel" factories, its own machine shop, and its own power plant, which controls the automatic sprinklers, reservoirs, overhead water tanks, two large fire pumps, and the electric lighting as well as the ventilating system. A tube system, Lamson carrier lifts, endless carriers, electric push buttons and enunciators, work handling appliances, an electric time clock, an oil-burning power plant, and a battery of eleven elevators, five of which are of the passenger type, are included among the other conveniences provided. Three of these elevators have a capacity of 180 passengers per trip, and are used exclusively for the purpose of transporting women employees to and from the upper floors of the plant.

The production layout is unique and is designed to provide economy in manufacture. The basement of the factory is given over to the storage of soles and heels, innersoles, counters and other accessories, and the supply department is operated upon a scientific plan of requirements for everything used in producing the famous Queen Quality and Dorothy

Dodd shoes. Here also are stored the infinite collection of parts for the machines operated in the factory.

The In-Stock departments at Boston and Atlanta carry the largest quantity of women's shoes in its grades of any concern in the country to supply the demand for instant service to dealers, and the volume of this unit alone runs close to \$2,500,000 a year.

In the Inspection Department each shoe is examined for defects in stock and workmanship, made ready for cartons, and either delivered to the shipping room, to the customer, or to the warerooms for later distribution.

No small part of the success of the concern has come from the Experimental Department, where, under the direction of a competent stylist, experimental activities are constantly carried on, which result in finished styles insuring exclusiveness in design, in fit, and in style appeal. Here are worked out the company's latest models, and here also every new idea is considered, examined and determined upon if it is believed it will make for better women's footwear.

The example of the Thomas G. Plant Corporation, in the export field is one that might well be taken advantage of by the shoe manufacturer who complains that he cannot build a permanent foreign business. From its beginning, the Plant company has catered to the individual whims and caprices of each country where it desires to do business, and has provided special lasts and designs suited to the particular local customs and conditions of each nation, with the result that it has been singularly successful in its export business.

The company gave consideration in locating its Boston factory at the corner of Bickford and Center streets, to its buyers and to visitors, and at its local general office, in the plant, upwards of 1,500 letters are received and answered daily.

In addition to the distributing department in Boston, it maintains a distributing house, in Atlanta, Ga., to take care of the southern business, while sales rooms are maintained in Chicago and New York. It also operates a branch factory at Somersworth, N. H.

Every consideration has been given by the management to the welfare, health and recreational facilities of its army of employees. Rest rooms are provided, equipped with every facility for the care of those who become suddenly ill, or who may meet with accidents; a women's recreation room and a dance hall for social gatherings, a private recreation park, with an area of over 100,000 square feet, are maintained for the exclusive use of employees. For those whose homes are distant from the plant, a large restaurant is operated, where lunches of wholesome food, are served at a nominal cost, and where a box lunch service is also available.

The male employees are provided with a large recreation room with six pool and billiard tables, and many card tables. Each employee is afforded a private sealed locker, while a check room is provided where valuables may be placed for safe keeping. Fifty-four drinking fountains are placed at advantageous points throughout the plant.

The company daily produces close to 6,500 pairs of women's welt, McKay, Littleway and Superflex (cement) process shoes. Plans are now in progress to largely increase this output.

Never content with its past, the concern is constantly invading and

conquering new fields, its latest outstanding achievement being discovery of an entirely new principle in the construction of arch feature shoes. Within six weeks following the official announcement of this new type of footwear, in January, 1929, it was manufacturing and marketing over 1,000 pairs per day.

The corporation has capital of \$3,712,000 and employs approximately 2,000 operatives.

C. J. Prescott is president, F. R. Maxwell, vice president, F. H. Rowson, secretary and treasurer, and the directors are E. H. Ellison (chairman), C. J. Prescott, F. R. Maxwell, J. Frank McElwain, S. R. Blakeley, Louis J. Hunter, Stanley King and James R. Gormley.

THE WILKINS PAPER BOX COMPANY

In 1892, Charles L. Wilkins associated himself with three brothers in Milford, N. H., and began the manufacture of paper boxes. Realizing the disadvantages of production and distribution in a circumscribed field, the four brothers formed a corporation and purchased the paper box business conducted by Charles F. Adams, on Bowker Street, Boston, on May 1, 1900, and with Charles L. Wilkins in charge as treasurer and manager, a removal was made from Milford to this city.

Steady expansion necessitated a change to a larger plant, and in 1907 the corporation removed to 59-69 Beverly Street, where it is now located. When additional space was required in 1914, an adjoining building on Medford Street, was taken on.

The business continued under the sole management of C. L. Wilkins until July, 1919, when his son, C. Howard, a graduate of Massachusetts Institute of Technology, on his return from overseas service in the World War, became associated with the company.

In 1920 the corporation was reorganized and incorporated under the laws of this Commonwealth in which year likewise, its capital was increased to \$50,000. From the beginning a good share of the profits have been put back each year to keep the plant in up-to-date condition. Some of the company's customers have been on the books continuously since the business was started in 1892.

H. H. Wilkins is president, C. H. Wilkins, secretary, and C. L. Wilkins, treasurer, and fifty operatives are employed.

THE STAR REFINING COMPANY

The Star Refining Company, smelters and brass founders, began operations in 1892, and was founded by Edward P. Barrett, who for several years previous had been treasurer of the Mowrey & Phillips Co., who then engaged in the same line. The new company was successful from the start and supplied brass, bronze and aluminum castings from patterns. It now furnishes, from its own refinery, solder, babbitt, zinc, ingot brass and composition metals of special alloys, and is a large purchaser of machine shop scrap.

In July, 1927, the company purchased the Peckham Brass Foundry, which for many years had carried on business on A Street, a short distance from the Star unit, and the plants were combined under one management at 116 West First Street.

Edward P. Barrett served as president and treasurer until his death in June, 1928, and was succeeded by Henry K. Roberts, who, after gradu-

ating from Harvard College, entered the concern, in 1904, and soon afterward became superintendent and plant manager, and later secretary and a director.

Following Mr. Barrett's death, the business was reorganized, and the foundry department was sold to the Somerville Machine & Foundry Co. The Star Refining Company is now exclusively engaged in smelting and refining metals, and has capital of \$100,000.

THE BARBOUR WELTING COMPANY

In 1892, John Barbour, father of the present owner of the Barbour Welting Company, began the manufacture and sale of rands, in a small room in the downtown section of Brockton, under the name of the Brockton Rand Company, and a few months later the founder's son, John A. Barbour, was admitted to the partnership, which continued until 1910, when John Barbour died.

In the meantime, the business had prospered, and had changed in character. Larger quarters had been secured in the Lilly-Brackett shoe factory, and the manufacture of heels had been developed into the largest department of the concern.

On July 23, 1900, Perley E. Barbour became associated with the business, and after the death of his father became a full partner with his brother.

Seven years later the quarters were outgrown, and the concern was moved to the Montello district, where the famous old James Mean shoe factory was acquired from the W. L. Douglas Shoe Company, which at that period was operating it as its No. 2 plant.

At about that time the manufacture of welting was added, and the rand and heel business was dropped, the entire energies of the partners being devoted to the production of welting. Later the plant was purchased, and during the past fifteen years has been enlarged four times, until today it affords 240,000 square feet of area. The name of the concern was changed to Barbour Welting Company, and upon the death of John A. Barbour in 1925, Hon. Perley E. Barbour became the sole owner.

Originally, the manufacture of welting was a comparatively simple operation, a few styles, sizes and colors caring for the demands of the shoe trade, but as the Goodyear welt process grew throughout the country, the ramifications of the welting business were broadened. New styles, patterns, colors and patented novelties were added to the line until today anything and everything that can possibly be used as a welt is produced in the Montello factory. Among the company's patented specialties is the well-known Stormwelt, which in the last five years has sold to the extent of millions of yards.

The third generation of Barbours is now a partner in the business, as Walter G. Barbour, son of Hon. P. E. Barbour, became associated with the concern two years ago. The present capacity of the plant is 150,000 yards of welting a day, and the product finds a market in every community in the civilized world, where shoes are made by the welt process. The Barbour Welting Company has export connections in twenty-seven foreign countries, and operates its Boston office at 12 High Street.

Hon. Perley E. Barbour is publisher of the *Quincy Evening News*, of

Quincy, his "home town," and he is a partner in the Hayward Hosiery Company of Ipswich. He served for two years as the mayor of Quincy.

THE GORDON SUPPLY COMPANY, INC.

On March 18, 1892, the late Frederick D. Gordon established in the basement of a private residence on South Newton Street, Boston, the manufacture of linen coats and aprons for barbers, dentists and restaurants, shortly after removing to Massachusetts Avenue, and eighteen months later to the present location at 537 Albany Street, where the enterprise utilized a small area. Today it occupies practically all of the five-story structure.

In 1904 the concern was incorporated as the Gordon Supply Company. The founder personally delivered the first coats made by him to a barber shop located in the old Park Square depot, which stood where the Statler Building and the Motor Mart are now located. From the small basket in which he carried the products has emerged the fleet of delivery trucks which distributes the thousands of coats, aprons and other linen supplies to druggists, dentists, barbers, restaurants, beauty parlors and others. The company is the largest of its type in the United States, its territory embracing New England, New York City, Newark, N. J., and Philadelphia.

Frederick D. Gordon was president of the concern up to his death in 1914.

The corporation has capital of \$250,000 and employs upwards of 275 operatives.

John M. O'Donoghue is president, and Melville L. Hughes, treasurer and secretary.

FRENCH, SHRINER & URNER

In the early sixties, Joseph E. French, of Rockland, began to manufacture a type of extra quality fine shoes, and in 1893 associated himself with Charles J. Shriner and S. P. Urner, under the corporate name of



FRENCH, SHRINER & URNER SHOE FACTORY, BOSTON

French, Shriner & Urner, in which town they continued to operate until 1905, when the factory was removed to Boston.

Four years later they removed to a modern and up-to-date plant at 63 Melcher Street, at which location they have continued to specialize in extra quality welt shoes for men.

The corporation opened its first retail store in New York City more than thirty years ago, and now has a chain of seventeen such shops in New York, Brooklyn, Chicago, Cleveland, Philadelphia, Detroit, St. Paul, Kansas City, Seattle, Minneapolis and Boston, and in addition has dealer-agents in nearly all the larger cities and towns in the United States.

The present officers of the corporation are president, Blanchard U. Shriner; vice president and treasurer, Ivis B. Shriner, and secretary, William P. Burnham.

The corporation has capital of \$500,000 and employs upwards of 175 operatives. Known for the sterling quality of its products, French, Shriner & Urner have upheld the high traditions of Massachusetts manufacturers for well nigh three-quarters of a century.

THE LINSKOTT-TYLER-WILSON COMPANY

The Linscott-Tyler-Wilson Company whose Boston headquarters are at 167 Lincoln Street, is the successor of Perkins, Jones & Co., which was founded in 1893. Five years later the firm of Perkins, Linscott & Co. was formed and in 1906 the Linscott-Tyler-Wilson Company was incorporated.

The company's factory is in Rochester, N. H., where men's and boys' medium-grade Goodyear welt shoes are produced, the plant having a capacity of about 2,500 pairs per day. The products are marketed principally to the wholesale trade and to large distributors of shoes in the United States and Cuba.

The corporation has capital of \$300,000 and is organized under Massachusetts laws.

Daniel Tyler is president, and Robert G. Wilson, secretary and treasurer.

THE SPATULA PUBLISHING COMPANY

The Spatula Publishing Company was founded in 1893 by the late Irving P. Fox and was incorporated in 1900. It prints, publishes and sells business books and literature for the retail druggist and until recently published *The Spatula*, a druggists' magazine having a nation-wide and a large foreign circulation.

The company also engages in general commercial printing and does a large amount of church printing and publishing. For many years it has printed *The Church Militant*, the official publication of the Episcopal Church, in the Diocese of Massachusetts, and the company employs about fifteen at its 79 Sudbury Street plant. Fred J. Fox is president and treasurer.

THE H. & B. AMERICAN MACHINE COMPANY

The H. & B. American Machine Company was established in Pawtucket, R. I., in 1894, under the name of Howard & Bullough American Machine Company, Ltd., for the manufacture of cotton preparatory and spinning machinery. In 1911 the name was changed to H. & B. American Machine Company.

For many years Messrs. Howard & Bullough, Ltd., of Accrington, England, had exported considerable machinery to America through their agents, Messrs. C. E. Riley Company, of Boston. Mr. Riley, having been identified with the textile trade for a number of years, erected a plant at Pawtucket, to produce a similar line of machinery to that built by Messrs. Howard & Bullough, Ltd.

The output at first consisted only of pickers, cards and drawing frames, but the increasing demand prompted enlargements to include the manufacture of slubbing, intermediate and roving frames, and a few years later further additions were provided for producing spinning frames and twistors. The company is prepared to furnish a complete yarn mill equipment, the output being approximately a ten-thousand spindle mill weekly. The product is extensively used by many of the best known cotton mills in the North and South, as well as in Japan and South America.

The plant covers many acres, and the foundry and machine shops are equipped with the latest and most improved machine tools, electric cranes and trucks for handling all heavy parts. Group and individual motor driving is adopted throughout the mill. About 1,200 skilled operatives are employed, and the company maintains a service department, where each man's record is taken on entering their employ, and much attention is paid to his safety and welfare. A social and athletic association is managed by the employees, and the corporation maintains a scientific school for educational purposes. The officers are: president, C. E. Riley, of Boston; treasurer, E. R. Richardson, of Pawtucket; vice president and secretary, E. L. Martin, of Providence; purchasing agent, J. W. Richardson, of Providence, all of whom have been associated with the company for many years, and are highly regarded throughout the textile trade.

The Boston offices are at 161 Devonshire Street, where President Riley has his headquarters, and a Southern office is maintained at Atlanta, Ga.

THOMPSON & LICHTNER COMPANY, INC.

When Sanford E. Thompson was graduated from the Massachusetts Institute of Technology, in 1889, he formed a partnership with Frederick W. Taylor, and a few years later he became associated with William O. Lichtner, who had served in various executive positions in industry, following his graduation from the Armour Institute of Technology, and the firm of Thompson & Lichtner was formed, which was later superseded by the present corporate organization, known as the Thompson & Lichtner Company, Inc.

From a modest beginning the corporation has gradually grown in comprehensiveness and prestige until it includes six distinct divisions, whose efforts are coördinated with the executive staff to produce greater manufacturing effectiveness. The Marketing, Production and Management, Cost and Accounting, Research, Industry, Coöperation and Engineering and Testing units are each under the direction of men peculiarly qualified to handle special functions.

The Marketing Division specializes in expert analyses of markets, selling organization, sales policies, and advertising programs, as well as in the development of improved merchandising methods, new markets, and new products, in the reduction of selling costs and the development and

adjustment of salesmen's compensation and territorial assignments, and this service has resulted in increasing both sales and profits for many clients.

The Production and Management Division performs constructive work in the development of balanced production and sales programs in standardizing and simplifying methods, "work-in-process," and inventory reduction, gives comprehensive advice on matters of general policy, organization structure and layout, on the assignment of authority and responsibility, establishes controls for chief executives, develops budgetary control, and coordinates all phases of operation, thus affording clients a viewpoint which is not confined to isolated technical subjects and problems, but which considers management matters and their relations as a whole.

The Financial and Accounting Division deals with the design, installation, revision and supervision of cost procedure, carries on investigations of earning power and financial condition, the preparation of audits and renders tax service, and is carried on from the standpoint of the chief executive, thus forming the basis of budgetary control or standard cost procedure.

The Construction Division designs or reviews designs of structures, supervises construction, inspects or tests structural materials, including structural steel at mills or warehouses, carries on field inspections, conducts routine and special tests of concrete aggregates and designs proportions, offers consultations on special construction problems and provides technical research in developing new products and in the improvement of industrial processes.

The Research Division executes studies of manufacturing and merchandising groups, trade associations, and community, regional or national civic and business organizations, the work along this line including researches for the Hoover Committee on elimination of waste in Industry, the United States Coal Commission, the New England Council, and the Boston Chamber of Commerce.

The Industry Coöperative Division develops active working programs for the promotion of industry, education and coöperation, for the elimination of destructive price-cutting, for the stabilization of profits, and in other ways it serves to establish and encourage industry, good will and prosperity.

Up to 1928 the corporation had its headquarters in the Boston Chamber of Commerce Building, but that year it removed to the Statler Building. The Western headquarters are in the Engineering Building, in Chicago, and the New York City activities are handled through a nationally-known association of manufacturers, with which the Boston concern is affiliated.

Although the Thompson & Lichtner Company, Inc., has served hundreds of clients in a wide variety of industries during its existence, it has always followed a policy of limiting the total at any one time in order that it might closely supervise its executive personnel. Its executives believe that mass production principles are not adapted to the most effective application of professional engineering assistance.

Colonel Sanford E. Thompson is president; William O. Lichtner is vice president and treasurer, and Verda M. Spear is secretary.

THE INTERNATIONAL GLUE COMPANY, INC.

The International Glue Company, Inc., located in East Boston, manufactures high-grade liquid glues. Located in the very heart of the fishing industry, it is in a good position to procure fresh fish waste throughout Boston, and produces nothing but the finest of glues.

The concern is one of the pioneers in the glue industry on the Atlantic Coast, having been organized in 1894, and employs from twelve to eighteen men.

A large percentage of the glue manufactured by it is sold for domestic purposes, although a considerable amount is exported to foreign countries.

C. Thurston Peterson is president of the corporation, which has capital of \$51,900.

THE ABERTHAW COMPANY

In January, 1894, a group of young engineers, recently graduated from the Massachusetts Institute of Technology, formed an engineering and construction organization, which took the name of the Aberthaw Construction Company, in honor of the little Welsh seaport town of Aberthaw, where, nearly two centuries ago, the materials were quarried for the manufacture of the first Portland cement.

In 1894 this material was just beginning to receive recognition in the building industry, and it appealed to these engineers as possessing remarkable qualities which would one day make it a formidable rival of, as well as an ally to, brick, steel, and timber. With this thought in mind the group decided to specialize in its use in reinforced concrete construction and it seemed appropriate to incorporate the name of the birthplace of the material into the name of the company, which became the pioneer in the use of reinforced concrete in New England. Subsequently, the word "Construction" was dropped from the corporate name and the concern became the Aberthaw Company.

Starting with small capitalization its early work consisted principally in the building of sidewalks, many of which are still in existence, but ere long it developed into one of the foremost construction companies in the country and it has handled numerous single contracts running into many millions of dollars.

The present officers are: L. C. Wason, president and treasurer; S. L. MacMillan, vice president and general manager, and A. B. MacMillan, secretary, and the main office is at 80 Federal Street, Boston.

A Marine Department, in charge of water-front construction, is maintained by Aberthaw in charge of E. P. Wells, this unit being located at 201 Marginal Street, Chelsea.

The company also maintains an Equipment Division, in charge of J. M. Sokoll, at 133 Southampton Street, Roxbury, which is retained for at 575 Albany Street.

the purpose of renting plants, tools, etc.

Still another branch is located in Providence, R. I., known as the Providence Marine Department, under the supervision of W. J. Creedon.

THE R. W. HULL COMPANY, INC.

The R. W. Hull Company was established in 1894, and was incorporated in 1916. It carries on the waterproofing, refinishing and shrinking

of fabrics. R. W. Hull is president and treasurer and the plant is located at 575 Albany Street.

Konrad Ziegler operates the Roxbury Dye House, at 54 George Street, which has a daily capacity of 4,000 pounds of raw stock and 6,000 pounds of yarn, the plant being equipped with twelve dyeing machines, and two boilers.

The Special Yarns Company whose plant is at 60 K Street, South Boston, is engaged in the dyeing and twisting of rayon, lustron and celanese yarns. Royal Little is treasurer.

The National Hosiery Dyeing and Finishing Works, managed by Arthur E. Cobin, dyes and finishes hosiery, at its 8 Thayer Street plant.

THE BOSTON MACHINE WORKS COMPANY

For thirty-five years the Boston Machine Works Company has been engaged in the manufacture of machines which are used extensively in shoe factories all over the world, such as the Booth folder, the Julian cementer, the Edwards embossing machine, piano action machinery and other specialties. Two hundred to 250 men are employed the year round and sales agencies are maintained in St. Louis, Chicago, Cincinnati, Columbus, Milwaukee, Rochester, N. Y., Haverhill and Brockton, and eight foreign branches are operated in London, Paris, Frankfort, Copenhagen, Zurich, Milan, Rio de Janeiro, and Melbourne.

The company's oil burner division is under expert management, with a corps of experts from six to twelve years' experience. The company manufactures domestic oil burners up to a capacity of 1,500 feet of steam radiation, kitchen range oil burners, and a full line of automobile oil burner controls, such as aquastats, pressurestats, thermostats and Hi-Lo gas controls.

At the Boston plant is a special department for the manufacture of all kinds of embossing materials for embossing shoes in gold, silver or colors.

The company has developed this process of embossing and marking shoes to a high degree by the introduction of especially designed machinery for performing the work on a practical basis, the method enabling the manufacturer to postpone the stamping of any trade-marks until the shoes reach the packing room, thus avoiding losses that might be brought about by last minute cancellation or other causes.

The corporation has capital of \$100,000 and operates plants in Boston and Lynn. Charles E. Riley is president and R. H. Illingworth, treasurer and general manager.

THE BOSTON PNEUMATIC TRANSIT COMPANY

The Boston Pneumatic Transit Company, whose sole service has been the transportation of mail and parcels by pneumatic tubes, was organized in 1896, and on July 1, 1897, its first contract was executed with the United States Government, for a pneumatic tube service between the Boston Post Office and the North Station. The tubes were constructed under the Batcheller Pneumatic Tube Company patents and were installed in December of that year.

In 1899 the American Pneumatic Service Company was formed, of which W. E. L. Dillaway was president, and this corporation bought the

Lamson Company and other companies, including the Boston Pneumatic Transit Company.

In 1901 pneumatic tubes for carrying parcels were built, and in 1903 other tubes were constructed for carrying the United States mail connecting the North Railway Station, the General Post Office, the South Railway Station, the Essex Street Post Office, the Back Bay Post Office, the Station A Post Office, the Roxbury Post Office and the Upham's Corner Post Office, a distance of 6.84 miles.

This service continued until 1918, when, by an act of Congress, it was discontinued and remained inoperative until 1926, when the lines connecting the General Post Office, the North Railway Station, and the South Postal Station were resumed, covering a distance of 1.6 miles, this part of the system being still in operation.

Underground pneumatic tubes are applicable to a multitude of uses because they operate without interference from traffic congestion, inclement weather, parades, riots, robberies and similar disturbances incidental to surface transportation. The carriers are dispatched by underground pneumatic tubes on a ten-second headway, which, in view of the uninterrupted service are constantly available, and because of the safety with which they move beneath the surface, they hold a unique position as a transportation utility. Merton L. Emerson is president; E. E. Morris, clerk, and John S. Ogg, treasurer of the corporation which has capital of \$50,000.

THE E. E. TAYLOR COMPANY

In 1896, Edward Everett Taylor founded the shoe firm of E. E. Taylor Company, which grew with much rapidity until in its several factories in Brockton, New Bedford, and Nashua, N. H., 2,400 operatives are employed. The company is capitalized for \$2,250,000, and has a daily output of 20,000 pairs of shoes. Upon the death of the founder, his nephew, George M. Peabody became president and treasurer of the corporation, and J. A. Trask is secretary.

THE AMERICAN PULLEY COMPANY

During the thirty-odd years of active business of the American Pulley Company, New England has been one of its major markets, with Boston as a key point and later a distribution center. Since 1896 American Pulley Company products have been sold in New England, and in that year a stock of steel pulleys was placed with a dealer in Boston and these articles were exclusively distributed by him in local territory.

As time went on, other dealer connections were made and in 1911 the prime importance of the New England market became so evident that it was considered necessary to establish a branch factory, office and warehouse here to the end that stocks of the various products of the company might be carried for quick and easy distribution.

Boston was selected as the city best adapted for the headquarters, not only because of its location in the heart of a highly industrialized community, but also on account of its availability for shipments from Philadelphia by both rail and water, and a branch was established at 165 Pearl Street.

The wisdom of this decision has been amply proved, as the Boston

branch has not only paid its way, but is considered an essential factor in the sales plan and an important part of the machinery of distribution.

In 1926 the factory branch was moved from Pearl Street to an improved location at 175 High Street, where it is now established. Here complete stocks of steel split pulleys, pressed steel shafting hangers, bearings, and steel hand trucks, and shafting collars are carried.

No less than ninety-three dealers, who purchase and sell the products of the American Pulley Company, rely upon the Boston branch to replenish their stocks of merchandise, fifty-four of this total being located in Massachusetts.

THE FOLSOM ENGRAVING COMPANY

In 1896 L. B. Folsom and Charles G. and A. F. Sunergren, under the firm name of Folsom & Sunergren, established a photo-engraving plant at 25 Winter Street, Boston. In 1911 the concern was incorporated and four years later the name was changed to the Folsom Engraving Company. For twenty-five years the plant was located at 88 Pearl Street, and in 1926, when the necessity arose for larger facilities to take care of the fast increasing volume of photo-engraving, a new factory was secured in the Harbor Building, at 470 Atlantic Avenue. This plant is one of the largest of its kind in New England, and is equipped with the latest and most approved equipment, for the production of photo-engraving, including line and halftone engraving process color and miscellaneous color engraving, designing, drawing and commercial photography.

L. B. Folsom is president and treasurer of the corporation, which employs sixty hands.

JEFFERSON KIER, INC.

In 1897 E. D. Jefferson began the manufacturing of bleaching kiers and later D. R. Weedon entered the partnership familiar to the textile trade under the name of Jefferson-Weedon, since changed to Jefferson Kier, Inc. The past three decades have witnessed many developments in the treatment of cotton cloth before it enters the kier and an infinite number of changes have occurred in that period in the method of finishing it after being boiled in the kier, but to date there has appeared no method of avoiding the necessity for kier boiling to obtain a fine finished fabric.

The two partners with their more than thirty years of experience in studying and perfecting the mechanical as well as the chemical treatment of goods in the kier hold a very high position in this field today. A vast amount of study and experiment have been put into the perfecting of kier circulation and temperature control by mechanical means. Many finishing plants throughout New England, as well as in other sections of the country, have adopted the Jefferson-Weedon form of kier circulation as it is easily adapted to existing kiers.

During this long period there have been placed on the market by the local concern kier circulating systems in three distinct steps. Each represented an advance over its predecessor, and the present system having been on the market for approximately ten years has become widely known throughout the trade. Jefferson Kier, Inc., is one of the oldest, if not the oldest concern in its line in this country, and both partners are

active in its management. E. D. Jefferson is president and treasurer, and R. C. Jefferson, vice president.

L. C. PAGE & CO.

In 1897 Lewis C. Page, who had been identified with the old publishing house of Estes & Lauriat for six years, formed the firm of L. C. Page & Co., which today occupies a beautiful and historic Beacon Street mansion as its headquarters.

The Page books perpetuate in their fiction the good old tradition of more illustrations than are commonly found in novels nowadays. The list is general, but has gained special fame through the inclusion of the Pollyanna books, now carried forward, since the death of Mrs. Porter, by Harriet Lummis Smith, and for the beautiful Spell series of travel books, which now numbers more than thirty volumes. Among its numerous excellent juveniles is "The Little Colonel Series," by Annie Fellows Johnston, numbering twelve volumes. The corporation has capital of \$250,000. L. C. Page is president, and C. B. Chapman, treasurer and secretary.

THE AMERICAN STAY COMPANY

In 1898 the Union Welting Company was incorporated; with Frank W. Merrick as president, and Clarence S. Luitwieler as treasurer, they owning all the stock, and upon the death in 1906 of J. G. McCarter, who had founded the business of the J. G. McCarter Company, in 1888, the assets of that concern were purchased by the Union Welting Company and the American Stay Company was organized, the original capital of the latter enterprise being fixed at \$150,000, of which \$91,200 was issued. Later this was increased to \$300,000.

Upon the merger of the two plants, land was purchased on the East Boston water-front, adjacent to the Bethlehem Shipbuilding plant, and close to the present Boston airport, where the largest factory in the United States engaged in manufacturing shoe trimmings was built. The original products were shoe welting and trimmings, and automobile trimmings, all the machinery for the manufacture of these lines being designed by Mr. Merrick. A small machine shop was added to the plant, and during the World War this was enlarged and an organization was perfected for the designing and building of special machines requiring great accuracy and high-grade craftsmanship.

At the present time 32,000 square feet of floor space are utilized, and 100 operatives are employed.

Mr. Merrick is one of the pioneers in the shoe machinery field, and many of his more than one hundred patents now in successful operation, have revolutionized shoe making methods.

For nearly fifty years Mr. Luitwieler has been identified with the shoe industry. In 1893 he spent a year in England establishing needle plants for the Torrington Company and operated five distributing stores for that company over a period of twenty-five years. Later he became assistant general manager of the New Home Sewing Machine Company of Orange, resigning that position to organize the American Stay Company. Messrs. Merrick and Luitwieler have been associated in business continuously for thirty-nine years. Frank W. Merrick is president; Clarence J. Luitwieler, treasurer, and E. B. Luitwieler, general manager.

In 1898 H. E. Locke & Co., Inc., was established, and in 1917 the

concern was incorporated, with a capital of \$300,000. Sewing threads have constituted the company's products since its inception and 125 operatives are employed.

H. E. Locke is president; C. A. Kendrick, treasurer; J. E. Cambria, vice president; E. P. Turney, secretary, and D. B. Beers, factory manager.

THE M'KENZIE ENGRAVING COMPANY

The McKenzie Engraving Company was founded in 1898 by C. J. McKenzie to engage in commercial and social steel and copper plate engraving, including business letterheads, cards, wedding invitations, announcements, coats-of-arms and other forms of engraved stationery.

As a result of the fine character of work produced, the company has enjoyed a continuous growth and several times has been forced to seek more commodious quarters to satisfy the demands of its business.

In its first location at 78 Kingston Street, Boston, it occupied 250 square feet of floor space. In 1906 it removed to 155 Franklin Street, utilizing about 8,000 square feet of area. Again, in 1913, the company was compelled to seek larger quarters and it removed to 178 Congress Street, where it occupied 16,000 square feet of floor space. Later the company employed the entire area of this building, containing 24,000 square feet, and in addition occupied the building at 38 Pearl Street.

In 1927 the company purchased its own plant at 1010 Commonwealth Avenue, where over 500 people are employed. The company utilizes the entire building, which is a modern concrete and daylight structure of six floors, containing 52,000 square feet.

The McKenzie Engraving Company was one of the first to publish greeting cards in the United States and at the present is one of the largest manufacturers of this product in the world. Over twenty sales representatives sell "McKenzie Greetings" throughout the United States as of The Boston Line.

The officers are: C. J. McKenzie, president and treasurer; A. E. Benson, vice president and sales manager; C. F. Sollows, secretary and assistant treasurer.

BENJAMIN H. SANBORN & CO.

Benjamin H. Sanborn & Co. was incorporated in 1898 to publish school and college textbooks, and by assignments from Leach, Shewell & Sanborn, and later by purchase from Thomas R. Shewell & Co., its immediate predecessors, it became the owner of various series of schoolbooks, whose ancestry dates back without break to the eighteenth century, and to the Daniel Staniford Grammar, printed for the author by Manning & Loring, of Boston, in January, 1797.

The Boston headquarters of the company are at 131 Clarendon Street, and the Sanborn concern also has offices in New York and Chicago.

THE NATIONAL MACHINE AND TOOL COMPANY

Since May, 1899, the National Machine and Tool Company has carried on a general machine business at 253 A Street, specializing in the building of special machinery and tools.

During the World War the plant was materially expanded for gov-

ernment work and for the building of standard machine tools for manufacturers in the vicinity of Boston.

James H. Reed is sole owner, and seventy-five hands are employed.

In 1899 the American Felt Company was incorporated, with capital of \$3,250,000, and the concern operates plants at Franklin, Norwood and City Mills, in this state, and in Glenville, Conn., Detroit, Mich., and Pic-tou, N. J., and maintains selling offices in Boston, New York and Chicago. It employs upwards of 500 operatives.

Robert F. Herrick is president, and G. A. Bramwell treasurer.

THE PROGRESS OF A BAY STATE CONCERN IN THE ELECTRICAL FIELD

The phenomenal development of electric power in Massachusetts and other parts of New England, so recently emphasized by the advent into this section of enormous utility enterprises from the Middle West and the announcement of immense power projects in the northern tier of states, as well as the intensive efforts put forth to control the circuits through which this additional power must flow to its market, constitutes not only a most significant indication of the confidence these capitalists have in the future of New England, but also accounts for the rapid growth of numerous units whose inventions and products have followed as a natural sequence the coming of these power agencies.

A conspicuous example of the present day situation is the Condit Electrical Manufacturing Corporation, now the largest exclusive producer in the United States of electrical protective devices for central station equipment, which had a very modest beginning in 1899, just at the close of the last century, under the name of the S. B. Condit, Jr., Company, its founder being Sears B. Condit.

Among the first to appreciate the value of oil in electrical protective devices, it brought out a complete line of oil switches and oil circuit breakers that year, and then engaged in the construction of switchboards. The story of its subsequent growth is but a rehearsal of the exceptional vision, enthusiasm and courage of its proponents, backed by the skill of many New England artisans who have literally grown up with the corporation since its pioneering days in a wholly untrod field. Three times in a quarter of a century, owing to a steadily expanding volume of business, it has been found necessary to seek new quarters, and, in 1925, a fifteen-acre tract was purchased at Hyde Park, where modern buildings, containing approximately 200,000 square feet are occupied, including one structure where a high tension laboratory has been installed, which has a transformer capacity up to 500,000 volts, as the executives of the concern are firm believers in the value of research.

In 1925 the company became a subsidiary of the American Brown Boveri Corporation of New York, but retained its former corporate title. In 1899 the company carried a mere handful of employees on its payroll, but today upwards of 600 skilled men are on its force. The number and variety of its products have likewise been enlarged until now it manufactures oil circuit breakers for every class of service, indoor and outdoor, underground and overhead, for voltage requirements up to 88,000 and interrupting capacities up to 1,500,000 kv-a, as well as safety enclosed switchboards of the removable truck type, slate panel and steel enclosed switchboards, steel meter houses, outdoor switch houses, indi-

cating and metering transformers, oil motor starters and industrial switches, and relay and control switches.

While the company's products were at first distributed mainly in New England, today they are marketed in all parts of the United States and in foreign countries, thus emphasizing again the obvious fact that given an opening for a new product New England invention and genius will find a way to produce what is required and a market in which to distribute it.

G. A. Burnham is president; J. T. Graham, treasurer, and C. E. England, clerk of the corporation, which has capital of \$3,750,000.

THE UNITED FRUIT COMPANY—AN AMERICAN GIANT

The possibilities of successfully importing bananas into the United States was brought to the attention of Andrew W. Preston, in 1870, by Capt. Lorenzo D. Baker, of Cape Cod, who brought a cargo of the fruit from Jamaica to Boston, in his schooner *The Telegraph*, that year.

Mr. Preston joined with Captain Baker in making further importations, and in 1884, finding it difficult to secure capital for an enterprise which seemed to many to be of doubtful stability, he enlisted the support of nine others, each of whom, with himself, subscribed \$2,000, and formed the Boston Fruit Company, with capital of \$20,000, to grow and import tropical fruits into the United States.

At the outset, the company carried on its business in the West Indian Islands of Cuba, Jamaica, and San Domingo, and did not invade Central America until some years later.

By 1890 the enterprise had grown to a point which justified an increase in capital to \$500,000 and even then the Boston Fruit Company had a surplus of \$31,000.

Ample capital and resources were thus for the first time made available for large-scale operation, essential to a stable, serviceable industry. New territories in the tropical jungle, in widely separated localities, were converted into extensive and healthful banana farms, thereby insuring adequate supplies of fruit for the market in case of losses by hurricane, flood or drought in any single area, and this policy of wide diversification of sources of supply is one of the outstanding reasons for the success of the present-day United Fruit Company.

Two years after Captain Baker interested Mr. Preston in the importation of tropical fruits, Minor C. Keith, a youthful American, shipped from Colon to New Orleans 250 bunches of bananas, a consignment that flooded the market of the Louisiana city.

Mr. Keith had gone to Costa Rica, in 1871, when he was but twenty-three years of age, to assist in supervising the construction of a small railroad, and following his initial shipment of the following year, he began laying out banana plantations in the lowlands of the country, and through the medium of the railroad he was building he was enabled to transport the fruit expeditiously to Port Limon, its terminus on the Caribbean.

Soon bananas became popularized in the Southern market, and as the demand increased he determined to satisfy it.

But it was a long and hard struggle that he faced, for the railroad constructed by Mr. Keith and his brothers, although only one hundred miles in length, required nineteen years in the building before the last

spike was driven linking the interior of Costa Rica with the Atlantic Coast line. The first twenty-five miles of track, laid through the deadly lowlands, cost the lives of more than 4,000 men, three of whom were Mr. Keith's brothers.

The early days of the banana industry created by him were concurrent with those of railroad construction, and at times the problems involved seemed almost impossible of accomplishment. The fever-infested lowlands were so dreaded that it was necessary to bring laborers from Jamaica to complete the trackage, and had it not been for Mr. Keith's discovery of the potential market for bananas in the United States the road probably would never have been completed, because of lack of traffic.

Consequently, Mr. Keith was faced with the dual project of building a railroad and of creating a business, which could supply the transportation artery with an ample volume of freight.

Eventually the demand for bananas grew to such an extent that he was able to enlist American and British capital in the tropical fruit business, companies were formed, and additional acreage acquired, until by 1899 the Keith interests dominated the growing and exporting of fruit in Central America.

ANDREW W. PRESTON FORMS A NEW CORPORATION

In 1899 Andrew W. Preston reached the conclusion that the solution of the raising, marketing and distributing of tropical fruits lay in a union of forces. At that time there were no less than twenty-two separate fruit raising and purveying companies, and the industry required the hand of a genius to weld it into a composite whole, and to harmonize production and distribution.

Between 1880 and 1899 upwards of one hundred American companies were organized to engage in the importation of bananas, but four score or more of them had failed, due to the small acreage cultivated, to lack of manipulation facilities, or to poor marketing systems in this country, and to the inability to place them upon a sound business basis.

Mr. Preston's organizing ability resulted in the promotion, in 1899, of what in less than a quarter of a century later became one of the most remarkable organizations in the history of modern finance—The United Fruit Company.

On March 30, 1899, the corporation was organized with authorized capital of \$20,000,000, of which total \$1,650,000 was immediately subscribed and paid for in cash, at par, the original enterprise representing a merger of the Boston Fruit Company and the Keith interests. During the first year of operations stock to the value of \$11,230,500 was subscribed. In 1903 when further expansion was deemed advisable, an agreement was made with the English shipping line of Elders and Fyffes, which unit is now a United Fruit subsidiary, whereby the exportation of fruit to England and the Continent, was inaugurated, an outlet that has proved immensely successful.

Not only has the United Fruit Company become one of the largest single employers of labor in this country, but as a matter of history this gigantic fruit corporation has wielded a greater influence in popularizing the consumption of tropical fruits, not only in the United States,

but throughout the world, than any other agency that has existed since the dawn of civilization.

Its history constitutes one of the most fascinating romances in the history of American industry, due in no small measure to the fact that probably no other corporation conceived in this or the last century has attained its success under such severe natural handicaps.

In the first instance, it engaged in the production of fruits for which at the time it was created there existed a comparatively meager consumer demand, in consequence of which it was forced to create a market which could care for 59,000,000 stems of bananas each year.

Furthermore, the methods of transportation in the Central American countries where its enormous plantations are located were crude, primitive, slow and inefficient, and there existed practically no railways, making it necessary for the United Fruit Company to employ many millions of dollars in creating a modern railway system, which today has 1,642 miles of trackage, not to mention 680 miles of tramway—the railroad mileage alone that it owns and operates being practically equal to the combined mileage of the Delaware & Hudson and the Delaware, Lackawanna & Western Railroads, both sizeable systems in themselves, and three times the mileage of the Bangor & Aroostook Railroad Company. The United Fruit Company owns 205 locomotives and 7,743 cars. If the company's rails in the tropics were extended in a straight line, they would reach from Washington, D. C. to Denver, Colo.

Finding it impossible to secure proper shipping facilities, the company built its own vessels and today owns and operates the Great White Fleet of upwards of one hundred ocean-going steamships of more than 400,000 aggregate tons, and in addition charters many others. Those who hark back to the "good old days" point with pride to that long and picturesque era in the past when Boston and Salem derived their wealth from the activities of the merchant ship owners, who traded with the Indies, and they curiously deluded themselves into believing that such profitable days have long since vanished.

They fail to consider that half a dozen of the ships of the United Fruit Company are large enough to carry as much cargo as could the entire Boston and Salem sailing fleets in the heyday of their glory, nor do they realize that what this New England-owned and Boston-managed corporation is accomplishing in garnering the twentieth-century treasures of the Spanish Main makes the combined achievements of the old-time merchant princes of the Hub and the North Shore look pitiful in comparison.

The ships of the Great White Fleet steamed 5,945,136 nautical miles in 1928, and as a side line transported 72,203 passengers, 1,040,502 tons of freight, exclusive of the company's product, and 246,917 bags of mail, on 1,383 round-trip voyages. Its ports of entry in the United States are: Boston, New York, Philadelphia, Baltimore, Charleston, New Orleans, Mobile and San Francisco, and in Canada, Halifax, and St. John, while its tropical divisions are located in Cuba, Jamaica, Guatemala, Honduras, Costa Rica, Panama, Colombia and the Canary Islands.

Lacking in proper marketing facilities, Andrew W. Preston and his associates were forced to establish the company's own complete distribution system throughout the United States and in many foreign countries. Moreover, the United Fruit Company faced the location of its

plantations in the jungle and fever-infested swamps of Central America, as well as a complete lack of sanitation. The corporation officials found that until after its advent, the people had made little progress over the conditions that had prevailed for centuries there.

Today its tropical domain includes 2,477,285 acres, of which total it is cultivating 495,773 acres, and employing an army of 67,000 persons. Its advent into Central America, with improved sanitation methods and modern agricultural principles and equipment, has resulted in an advance in civilization there greater than has occurred in the same space of time in any other part of the world.

Before the advent of the United Fruit Company, commercial operations along the Caribbean shores and the adjacent lowlands of Central America were almost impossible on account of the dread tropical diseases in those areas. Realizing the necessity of first making the jungle safe for man to live in, the company has transformed the zone of its tropical operation into modern sanitary and healthful communities, and has established eight large modern hospitals with hospital and field dispensaries. Including employees, about 150,000 people receive annually the benefits of this medical and surgical service.

To assure the fullest utilization of its facilities the United Fruit Company maintains a radio-medical consulting service by means of which merchant ships secure free medical advice from the company's hospitals or from its steamships carrying physicians. This service is widely used and has been a factor in saving human life and ameliorating suffering at sea.

For the benefit of its personnel in the tropics the company maintains waterworks, electric light and ice plants, laundries and bakeries, and provides churches, schools, baseball grounds, tennis courts, golf courses and swimming pools.

It is the fixed policy of the company that its officials and employees in the tropics speak the Spanish language, and that while those who are not citizens refrain from all political activities and affiliations, yet they must support all that is best in the social and cultural life of the countries in which they work.

Practically from its inception the company has been engaged in research work covering the more important phases of production, transportation, sales and health problems. In its tropical divisions it maintains agricultural experiment stations, where large scale investigations of a great variety of soils, tropical plants, diseases and pests are conducted. At the company's principal experiment station in Honduras the general collection of tropical plants—carefully studied under natural conditions—is probably the largest of the kind in the American tropics. As a result of this work to date, the company has introduced new crop plants and greatly improved agricultural methods. The commercial collection in Panama of different varieties of bananas, secured from the Far East and elsewhere, is the most complete in the world.

The company also maintains at Boston a well-equipped laboratory and technical staff, and in its various lines of research it has the active co-operation of many well-known scientific institutions.

Closely allied with all physical operations and work of the company, especially development, production, transportation, purchasing and research, is the engineering department with its technical background and

skill, insuring the maximum of unity and effort throughout the organization.

Next came the designing of special cars in which to transport the banana stems to the company's docks, and the development of satisfactory refrigerator steamships, capable of transporting from 45,000 to 85,000 stems per trip, and so equipped as to maintain the fruit at an even temperature at any season of shipment.

Lastly came an extensive educational campaign designed to increase the demand for bananas through judicious advertising, which proved to be one of the most successful affairs ever conducted by an American corporation, and which did much to make the United Fruit Company not only the greatest agricultural enterprise in all the world, but aided it in taking rank as one of the foremost shipping enterprises of all times.

ITS PHENOMENAL GROWTH

That there has been no retrogression in the policy of the company is evident when one examines the activities of the enterprise. In the period from 1917 to 1927 it increased the acreage devoted to the cultivation of bananas in Colombia, Costa Rica, Guatemala, Honduras, Jamaica, Panama, and the Canary Islands, from 114,538 acres to 166,203 acres; its cacao plantations in Cuba, Costa Rica, Guatemala, Jamaica, and Panama, from 11,956 to 49,731 acres, or more than four-fold; its cocoanut plantations from 6,319 to 8,319 acres, and the area devoted to its miscellaneous products from 1,330 to 3,220 acres, while the pasturage lands were increased from 57,817 to 96,431 acres, and its town sites, lots, fire lines, etc., from 14,476 to 35,570 acres, giving it at the end of 1927 not less than 455,189 acres of improved land, as against 245,756, in 1917.

In 1928 the company had increased its cultivated and improved lands to 495,773 acres, of which 168,198 were devoted to banana culture; 92,047, to sugar cane; 45,997 to cacao; 7,827 to cocoanuts; 9,172 to miscellaneous products; 117,272 to pasturage, and 55,360 to town sites, roads, lots and fire lines. The total improved and unimproved company-owned or leased lands in 1928 was 2,477,285 acres, as against 1,274,990, ten years before.

The important physical development of the corporation is supplemented by the vast civilizing conditions which have followed in the wake of its Central American operations, where the company has proven to be the principal factor in not only bringing a degree of prosperity to a large part of Latin America than has heretofore been evident, but in raising the standard of living, in curbing poverty, ignorance and violence, in vastly improving health conditions by abolishing pestilences in the form of fevers and contagious diseases, in improving housing facilities and in modernizing the lowlands of the Caribbean Coast to a degree that one would have considered impossible a quarter of a century ago.

It is difficult to realize the magnitude of the company's operations unless one has seen some of its tropical divisions. When these divisions first opened they were, almost without exception, jungles with perhaps an occasional native town. The building of these areas is one of the romances of modern business, and the manner in which they were developed, with benefit to the citizens rather than "exploitation," constitutes another example of the beneficences that well-managed corporations render civilization.

Drainage and modern medical science were employed to make uninhabitable areas safe for all employees. The United Fruit Company's medical staff, with its modern hospitals and research department, is generally recognized as having made an outstanding contribution to tropical medicine.

In most of the tropical divisions the company has had to undertake the projects ordinarily performed by local governments, such as water supply, sewerage, streets, housing, amusements, parks, hotels, clubs, hospitals, stores and electric lights. Radio stations owned by a subsidiary, the Tropical Radio Telegraph Company, connect the tropical divisions with the home office in Boston, and with the steamships.

In addition to agricultural equipment, the company owns 29,000 cattle, 11,200 horses and mules, and about 4,000 other animals, in which list are embraced eighteen camels.

The company's sugar plantations in Cuba are equipped with two of the largest mills in that country, and have a capacity of approximately 1,500,000 bags, or 487,500,000 pounds of sugar annually, this commodity constituting no insignificant part of its operations.

With nearly 50,000 acres devoted to the chocolate bean, upwards of 8,000 acres producing cocoanuts, and nearly 4,000 acres devoted to the raising of pineapples, citrus fruits, and balsa wood, the corporation has been able to diversify its production risks and thus maintain stability of earnings, as well as to produce, in its main lines of business, the raising and marketing of a perishable tropical fruit, such as bananas, and the raising and refining of a highly fluctuating commodity, such as sugar, in such volume as to insure steady supplies to its thousands of customers.

The United Fruit Company now grows and transports half the entire supply of the world, and markets about one-half of the banana requirements of the United States amounting to 59,000,000 stems annually, each stem averaging from seven to nine clusters of bananas, or some 500,000,000 bunches, as the public terms them. Its banana shipments to the United States and Canada represent about 53% of the total imports of the countries where the crop is grown. The company's latest developments include the setting up of large divisions in Puerto Castilla, Honduras, and on the Pacific coast of Panama, while considerable fruit is purchased by it on contract in the various countries in which the corporation operates.

Not only does the enterprise have unusual diversification as to banana supplies, but it possesses diversification, too, as to market. Its wholly owned subsidiaries, The Fruit Dispatch Company, with offices in fifty-three cities in the United States and Canada, distributes bananas throughout this country and Canada. This company takes care of the fruit from the time it is unloaded, and it has a large staff whose sole business is expediting shipment in refrigerated or heated cars, a large proportion of which are leased by contract from freight car companies. In recent years the Fruit Dispatch Company has supplemented its ordinary sales efforts by extensive advertising campaigns. Distribution has been further facilitated by the opening of direct steamship service between Central American points and California.

About 35% of the banana sales are made abroad. To feed company employees at reasonable cost there have been established wholesale and

retail stores in most of the tropical divisions, and to accommodate tourists, the company operates two hotels in Jamaica.

During 1928 the company's payrolls in its tropical divisions alone amounted to \$26,000,000. That same year, the first twelve months' operations of the company's West Coast business, between San Francisco and the ports of Central America, Cristobal and Port Limon, showed extremely satisfactory results.

The company carries its own marine insurance, \$10,000,000, in government securities having been set aside in the treasury for that purpose, the income of which, based on its past experience, being sufficient to care for normal annual losses.

THE COMPANY'S ACTIVITIES

The constant, dependable freight service is available to manufacturers, merchants and shippers and includes information as to proper packing, coöperation in moving goods from interior points to the seaboard, and the preparation of shipping documents. Exporters and importers are assured of the careful handling of merchandise and its prompt delivery at the destination which foreign trade demands.

The company is represented by the principal tourist steamship and railroad ticket agencies in the United States, Canada and Europe. It maintains its own freight and passenger offices in various cities throughout the United States and has representation in the principal ports of Great Britain and the Continent.

In Honduras, the Tela Railroad Company operates a passenger and mail plane between the Atlantic Coast and the capital, Tegucigalpa, which is maintained primarily for the company's benefit, but is also available to the public, and is used by the Government of Honduras for transporting first-class mail. Tegucigalpa is not connected by rail with the Atlantic Coast, and this plane reduces the time of the trip from two or three days to about two hours.

Through the Tropical Radio Telegraph Company there have been established at various points in the tropics and in the United States powerful radio telegraph stations, which serve not only the United Fruit Company but the general public as well.

In Central America, Colombia and Cuba the company does a large merchandise business.

ITS REMARKABLE RECORD

From the financial standpoint, the United Fruit Company offers as remarkable a showing as it does from the production, marketing, and civilizing angles. What it has been doing financially for Massachusetts and New England can be readily understood by the man on the street, who examines its statistics.

In 1901, two years after it was founded, it had capital and surplus of \$13,573,434, paid dividends amounting to \$1,084,767, and the market value of its stock was \$10,000,000.

Twenty years later (1921) it had aggregate capital and surplus of \$134,955,774, paid dividends that year amounting to \$8,000,000, and the stock had a market value of \$123,500,000.

In 1927 its capitalization and surplus stood at \$181,000,000, it paid

dividends that year of \$13,570,000, while the market value of its stock was \$362,500,000.

It is one of the few great American corporations that does not owe a dollar for funded indebtedness, and, moreover, it does not have any preferred stock. The authorized capital stock is 3,000,000 shares of no par value, of which 2,625,000 shares are issued, and in 1928 it had 26,219 stockholders. In many ways its showing of financial strength is more remarkable than that of any other great corporation in the United States, and its wonderful increase in the last decade is most significant.

ITS PROGRESS UNDER PRESIDENT CUTTER'S REGIME

Since 1899, when the company was organized, the United Fruit Company has had but two presidents—Andrew W. Preston, one of its founders, and Victor M. Cutter, who, following his graduation from Dartmouth College, and upon completion of a special course at the Tuck School of Administration and Finance, entered the offices of the company, in 1904, and applied for a position. He was sent to Costa Rica, as a time-keeper at a salary of \$68 a month, but ere long he became an overseer, then a superintendent, a manager, a general manager, and, in 1924, vice president in charge of the tropical divisions of the company.

Following the death of Mr. Preston, in September, 1924, Mr. Cutter was the unanimous choice of the directors to fill the vacancy. Entering the office with definite ideas, plans and policies, gleaned from his study of the business in the tropics, he immediately organized a research bureau to study the soil, climate, rainfall, and quantity and type of fruit, and under his administration the corporation has enjoyed its greatest growth. He is one of America's foremost authorities in importing and exporting, and has done much to promote the export trade of New England manufacturers.

From the stockholder's viewpoint the United Fruit Company has made an unusual showing and in the last ten years owners of the company's shares have derived an exceptional profit. It must be remembered that for every share of stock held an additional share of stock was given to stockholders of record on December 20, 1920. And in 1926 the old stock was exchanged for new on a basis of two and a half shares of new stock for each old share, the new stock having no par value. In other words, stockholders who owned United Fruit shares in 1920, today have five shares for each one held at that time and when the consistent market action of the stock is remembered it can readily be seen how profitable these holdings have been.

Stockholders have increased as follows during the last twenty-seven years:

Year	Capital Stock Outstanding	Number of Stockholders
1899	\$ 11,118,700	361
1900	11,230,000	971
1901	12,369,500	1,608
1902	12,369,500	1,643
1903	12,575,500	1,865
1904	15,782,000	2,314
1905	17,485,000	3,232
1906	17,961,000	3,778

Year	Capital Stock Outstanding	Number of Stockholders
1907	18,825,000	5,122
1908	21,328,300	5,908
1909	21,340,000	6,160
1910	23,474,000	6,181
1911	27,058,900	6,658
1912	36,594,300	7,104
1913	36,594,300	7,641
1914	36,954,300	7,822
1915	36,594,300	8,259
1916	48,792,400	8,794
1917	48,792,400	9,653
1918	50,316,500	11,145
1919	50,316,500	11,049
1920	50,000,000*	11,849
1921	100,000,000	19,314
1922	100,000,000	19,920
1923	100,000,000	20,469
1924	100,000,000	20,644
1925	100,000,000	20,520
1926	2,500,000 shares†	23,881
1927‡	2,500,000 shares (No par value)	24,800

* \$50,000,000 stock distribution on share for share basis.

† Two and a half shares new stock given for each old share.

‡ As of July 1.

In each year of the company's existence common dividends have been paid, and from 1889 to date more profits have been put back into the property than have been paid as cash dividends. Its phenomenal record shows what present-day Massachusetts can do with an idea and a few dollars, in a little over three decades.

Despite the far flung interests of the United Fruit Company, the corporation is still managed from the main office in Boston and is largely owned by New England capital. Centralization of control, particularly of finances and operation, is made possible by an unusually efficient and standardized accounting system. It is always one of the first major companies to report its year's operations, and in 1927 its annual report was printed on January 10, and was in the hands of the stockholders two days later, a record which even small and localized companies seldom duplicate.

A perusal of the first and 1928 annual reports of the company discloses some interesting comparisons:

	1900	1928
Lands Owned and Leased (Acres) -----	236,201	2,477,285
Railways owned and operated (Miles) -----	112	1,642
Tramways (Miles) -----	---	680
Cars -----	289	7,743
Locomotives -----	17	205
Live Stock -----	14,166	44,540
Steamships Owned -----	10	72
Stockholders -----	361	26,219

These figures do not indicate that industry is declining in Massachusetts.

THE ECONOMIC SIGNIFICANCE OF THE COMPANY'S OPERATIONS

The banana industry, in which the United Fruit Company is a pioneer and the leading factor, has been responsible for the sanitation of widely extended tropical areas, the eradication therefrom of yellow fever and smallpox, and the progressive limitation of other diseases, notably malaria and its consequences. Whole regions, both those sparsely populated and a far greater unexplored territory, have been made habitable, and the people living there protected, kept in good health and able to earn a livelihood. Great plantations have been developed in the lowlands extending back from the Atlantic Coast of Central America and Colombia and vast tropical jungles, useless for other purpose than banana farms, have been cultivated and made productive.

In consequence of these accomplishments the entire business from plantation to wholesaler is today elaborately organized. In spite of the banana's highly perishable nature, the dealer and the consumer throughout the country are now able to secure without delay and at reasonable prices a regular supply of the fruit the whole year round. It is a fact that during the summer months, the company ships bananas even to points within the Arctic Circle.

Furthermore, the requirements of the banana industry have created a dependable system of radio communication and a constant and regular steamship service between the Caribbean ports and those of the United States and Europe, constituting an important link in the commerce of the world.

Created, comparatively within recent years, the banana industry has contributed definitely to the solution of the modern problem of the nations' food supply in both America and Europe and given to the markets of the temperate zone, at all seasons, an inexpensive and nutritious food-fruit, quite different in character and flavor from any of the fruits of the cooler climates.

Finally, the banana industry has been an important factor in creating a better understanding between the United States and the Caribbean countries and has contributed materially to their commercial development.

The general offices of the corporation are at 1 Federal Street, Boston. Victor M. Cutter is president, William Newsome, Sr., senior vice president, and Crawford H. Ellis, George P. Chittenden, William K. Jackson, Claude D. Doswell, Matthew C. O'Hearn, Henry E. Worcester and Hartley Rowe, vice presidents, Arthur E. Nicholson, secretary, Lionel W. Udell, treasurer, and Cecil B. Taylor, comptroller.

THE HENRICI LAUNDRY MACHINERY COMPANY

In 1899, the late W. A. E. Henrici began the manufacture of a fairly complete line of laundry equipment, but about 1910 production operations were changed to provide for the exclusive development of power-making machines of the metal type, the Henrici Laundry Machinery Company becoming the pioneer producer of all-metal apparatus, and at a period when the conventional type were made of wood.

The original Henrici metal washers were fabricated of steel, and glass enameled, but always on the alert for better materials, the concern later turned to Tobin bronze, a high-grade brass, and in more recent years, to Monel metal, a copper-nickel alloy, which is now being largely used by it. With the increasing interest in and development of the so-called stainless steels, the corporation has recently presented for the laundry interests a chrome nickel alloy steel, which is both non-corrosive and non-rusting and of far greater strength than any other material with which the concern has experimented.

The Henrici field is national in scope and many of the country's most exclusive hotels, institutions and hospitals, as well as high-grade commercial laundries, are equipped with the company's products, and among the local customers are the Copley-Plaza Hotel, the Boston City Hospital, the Massachusetts Homeopathic Hospital, the Boston Women's City Club, the Peter Bent Brigham Hospital, and some of the units of the New England Laundries, Inc.

L. F. Buff is president and treasurer, Henry Buff, secretary, and Fritz Henrici, vice president and assistant treasurer. The concern employs fifty men in its plant at 61 West Selden Street, Mattapan.

THE AMERICAN WOOLEN COMPANY

On the last day of February, 1899, the American Woolen Company was launched, at a meeting held at the Waldorf-Astoria, in New York City, with \$29,501,101 common and \$20,000,000 preferred stock, and on the 29th of the following month the articles of incorporation were filed.

Included in the original merger were the Washington Mills, of Lawrence, the Saranac Worsted Mills, of Blackstone, the Fitchburg Worsted Company and the Beoli Company both of Fitchburg, the National & Providence Worsted Mills, the Valley Worsted Mills and the Riverside Worsted Mills, all of Providence, R. I., and the Fulton Worsted Mills, of Fulton, N. Y. These plants were appraised at the time at \$12,000,000, and their certified earnings for the five years prior to the merger were \$2,593,000.

At that period the Washington Mills, the largest unit entering the merger, which were established in 1858, had capital of \$2,500,000, and were equipped with 18,828 woolen and 59,000 worsted spindles, and 1,200 looms. The next largest units were the National and Providence Mills, which had been consolidated in 1894, and were capitalized for \$2,000,000. Collectively they had 11,200 woolen and 31,000 worsted spindles and 400 looms.

The Washington Mills were the oldest in the group. The Fitchburg Worsted Mills were established in 1880, and had capital of \$250,000, the Beoli Company of that city was capitalized for \$300,000; the Valley Worsted Mills had been organized in 1872, and had capital of \$150,000, all three of these units being controlled by James Phillips, Jr. The Riverside Worsted Mills were established in 1884, and were reorganized six years later, and at the time of the merger were capitalized for \$1,000,000.

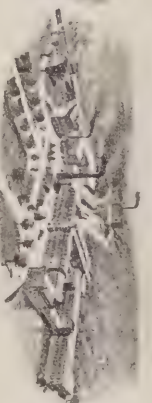
The products of the merged units included men's wear suitings, overcoatings; women's cloakings and dress goods; fancy cassimeres, clay diagonals and worsteds, French spun worsted yarns, and ordinary worsted yarns.



LOWELL MILLS, Lowell, Mass.



FALL RIVER MILLS, Fall River, Mass.



LAWRENCE MILLS, Lawrence, Mass.



NEW BEDFORD MILLS, New Bedford, Mass.



WRENTHAM MILLS, Wrentham, Mass.



BRIDGEWATER MILLS, Bridgewater, Mass.



NORTH and SOUTH WRENTHAM MILLS, Wrentham, Mass.



WRENTHAM MILLS, Wrentham, Mass.



NORTH WRENTHAM MILLS, Wrentham, Mass.



NORTH WRENTHAM MILLS, Wrentham, Mass.



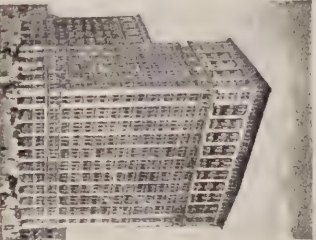
PITTS MILLS, Pitts, Mass.



ANDOVER MILLS, Andover, Mass.



ANDOVER MILLS, Andover, Mass.



ANDOVER MILLS, Andover, Mass.



BAY STATE MILLS, Lowell, Mass.



NEW BEDFORD MILLS, New Bedford, Mass.



MERRIMACK MILLS, Merrimack, Mass.



MERRIMACK MILLS, Merrimack, Mass.

PROPERTIES OF THE
American Woolen Company

21 State Street, Boston, Mass.

THE PLANTS OF THE AMERICAN WOOLEN COMPANY, BOSTON

Within ten minutes after the corporation papers were executed at the Waldorf-Astoria meeting, \$10,000,000 of the stock had been subscribed. Frederick Ayer, of Lowell, then the principal owner of the Washington Mills, was chosen president; Joseph G. Ray, of Franklin, vice president, William M. Wood, treasurer of the Washington Mills became treasurer of the new group, Edward P. Chapin, of Andover, assistant treasurer, and Joseph T. Shaw, of Boston, secretary. Thus all the officers were Massachusetts textile men. The months immediately succeeding the incorporation were spent in making plant acquisitions and in determining the personnel of the new concern.

By June the following concerns had been purchased and had become a part of the American Woolen Company; The Chase Woolen Company of Webster, the Faulkner Mills of Lowell, the Assabet Mills, of Maynard, the Collins Mills, of Collinsville, the Jesse Eddy Mills, of Fall River, Ray's Woolen Mills of Franklin, and the Plymouth Woolen Mills, of Plymouth, all in Massachusetts; the Vassalboro Woolen Company, of Vassalboro, the Kennebec Worsted Mills, of Fairfield, the Coburn Woolen Mills, of Skowhegan, the Brown Mills, of Dover, all in Maine; the Sawyer Woolen Mills, of Dover, the Baltic Mills, of Enfield, The Mascoma Flannel Mills and the Riverside Woolen Mills, both of Lebanon, and all in New Hampshire; the Manton Mills, of Manton, the Inman Mills, of Harrisville, the Sheffield Worsted Mills, of Pascoag, the Weybosset Mills, of Providence, all in Rhode Island; and the Milner Mills, of Moosup, Connecticut.

These mills were equipped in the aggregate with 363 woolen cards, 172,422 spindles, and 2,168 looms, which brought the totals up to 618 woolen and worsted cards, 349,356 woolen and worsted spindles, and 4,867 looms. The plants and equipment then in the consolidation were estimated to be worth \$25,000,000 and the company's annual report for the year 1900 showed that it owned 603 acres of land, on which were mill buildings containing 5,480,065 square feet of floor space.

Accessions were made month after month and year after year, including the Beaver Brook Mills, of Dracut; the Prospect Mills of Lawrence; the Bay State and Ram's Head Yarn Mills, both of Lowell; the Riverina Mills, of Medford; the Rochdale Mills, of Rochdale, in the town of Leicester; the Royalston Mills, of South Royalston; the Hecla Mills, of Uxbridge, which were subsequently sold, all in Massachusetts; the Forest Mills, of Bridgeton, the Foxcroft Mills, of Foxcroft, the Hartland Mills, of Hartland, the Indian Spring Mills, of Madison, the Newport Mills, of Newport, the Oakland Mills, of Oakland, the Ounegan Mills, of Old Town, the Pioneer Mills, the yarn plant of the Seabasticook Mills, and the Waverly Mills, all of Pittsfield, the Ames and the Anderson Mills, as well as the No. 4 Anderson Mills, all of Skowhegan, in the State of Maine; the Narragansett Worsted Mills, of Warren, R. I.; the Whitestone Mills, of Elmville and the Glen Falls Mills, of Moosup, in the State of Connecticut; the Globe Mills, of Utica, N. Y., the Burlington Mills, the Champlain Mills, of Winooski, Vt.; and the Bradford Mills of Louisville, Ky.

One of the most noteworthy extensions was the organization, in August, 1905, of the Wood Worsted Mills, of South Lawrence, with capital of \$1,000,000, which became an integral part of the American Woolen Company in 1910. The original plans called for two buildings, 1,000 by 125 feet, and 350 by 125 feet, each six stories high, the financing being

arranged by the issuance of construction and equipment notes for \$3,500,000, the units becoming the largest worsted mill in the world, possessing eighteen sets of woolen cards, 140 worsted cards, 146 combs (Bradford system), 25 combs (French system), 210,218 worsted spindles, 14,400 woolen spindles, and 1,502 looms. Next the Ayer Mills were built, at Lawrence, being completed in 1910, and which are equipped with 50 worsted cards, 400 broad looms, 60 worsted combs, 44,732 spindles, and nine boilers, each of 600-horse-power.

Then followed the erection of the Lawrence storehouse, six stories high and a basement, 160 by 170 feet, and the Merrimac storehouse, seven stories high and basement, 390 by 108 feet, and the Washington No. 10 storehouse, ten stories high, 154 by 165 feet. The Washington Mills, at Lawrence, are equipped with 101 worsted cards, 114 worsted combs, 1,432 broad looms, 81,648 worsted spindles, twenty-two boilers, and ten water-wheels, while the Prospect Mills, in the same city, have 6,400 worsted and 2,800 twist spindles, two boilers and two water-wheels. The total equipment of the Lawrence units alone is 291 worsted cards, 320 worsted combs, eighteen woolen cards, 14,400 woolen spindles, 3,332 looms and 336,508 worsted spindles.

On February 15, 1916, the American Woolen Company became a Massachusetts corporation.

Within recent years the company has acquired the Black River Mills, of Ludlow, Vt.; the Yantic Mills, of Yantic, Conn., the Tilton Mills, of Tilton, N. H., the Norwich Mills, and the Winchester Mills, both of Norwich, Conn., and the Webster Mills of Webster.

The company's plants and their equipment at the present time are as follows:

MASSACHUSETTS MILLS

	Cards			Spindles		Looms
	Woolen	Worsted	Combs	Woolen	Worsted	
Saranac, Blackstone	10	---	---	4,312	---	188
Beaver Brook, Dracut	33	---	---	12,960	---	152
Arden, Fitchburg	---	---	---	---	---	168
Beoli, Fitchburg	18	---	---	6,216	---	150
Ray, Franklin	9	---	---	3,000	---	50
Washington, Lawrence	---	118	116	---	107,096	1,458
Wood, Lawrence	18	140	146	14,400	210,128	1,470
Prospect, Lawrence	---	---	---	---	11,008	---
Ayer, Lawrence	---	75	80	---	44,732	320
Bay State, Lowell	25	---	---	9,360	---	140
Ram's Head, Lowell	6	---	---	---	1,500	---
Assabet, Maynard	138	---	---	55,660	---	700
Puritan, Plymouth	---	---	---	---	---	240
Rochdale, Rochdale	16	---	---	6,720	---	84
Chase Mills, Webster	17	---	---	9,870	---	164
Shawsheen, Andover	---	42	72	---	65,680	468
Webster, Webster	34	---	---	---	21,220	201
	324	375	414	122,498	461,364	5,953

MAINE MILLS

	Cards			Spindles		Looms
	Woolen	Worsted	Combs	Woolen	Worsted	
Forest, Bridgeton	8	---	---	2,700	---	40
Brown, Dover	11	---	---	4,520	---	80
Kennebec, Fairfield	10	---	---	5,320	---	62
Foxcroft, Foxcroft	12	---	---	3,780	---	50
Hartland, Hartland	15	---	---	5,850	---	74
Indian Spring, Madison	12	---	---	4,368	---	54
Newport, Newport	9	---	---	3,540	---	46
Vassalboro, N. Vassalboro	21	---	---	8,640	---	106
Oakland, Oakland	9	---	---	2,880	---	40
Ounegan, Oldtown	8	---	---	3,240	---	50
Pioneer, Pittsfield	17	---	---	6,672	---	80
Sebasticoak, Pittsfield	8	---	---	3,120	---	40
Anderson, Skowhegan	24	---	---	9,240	---	100
	164	---	---	63,870	---	822

RHODE ISLAND MILLS

	Cards			Spindles		Looms
	Woolen	Worsted	Combs	Woolen	Worsted	
Manton, Manton	---	---	---	---	---	186
Nat. & Prov., Providence	---	12	22	---	22,728	303
Weybosset, Providence	52	---	---	18,990	---	373
	52	12	22	18,990	22,728	862

NEW HAMPSHIRE MILLS

	Cards			Spindles		Looms
	Woolen	Worsted	Combs	Woolen	Worsted	
Sawyer, Dover	32	---	---	12,888	---	140
Baltic, Enfield	16	---	---	4,704	---	111
Lebanon, Lebanon	10	---	---	3,600	---	49
Mascoma, Lebanon	16	---	---	6,120	---	81
Tilton, Tilton	9	---	---	3,432	---	27
	83	---	---	30,744	---	408

CONNECTICUT MILLS

	Cards			Spindles		Looms
	Woolen	Worsted	Combs	Woolen	Worsted	
Whitestone, Elmville	---	---	---	---	---	44
Moosup, and Glen Falls, Moosup	15	---	---	6,840	---	100
Yantic, Yantic	16	---	---	5,496	---	82
Norwich, Norwich	21	---	---	7,056	---	120
Winchester, Norwich	20	---	---	---	---	---
	72	---	---	19,392	---	346

NEW YORK MILLS

	Cards		Combs	Spindles		Looms
	Woolen	Worsted		Woolen	Worsted	
Fulton, Fulton-----	---	6	---	---	38,400	402
Globe, Utica-----	18	1	---	7,920	6,390	160
	18	7	---	7,920	40,790	562

VERMONT MILLS

	Cards		Combs	Spindles		Looms
	Woolen	Worsted		Woolen	Worsted	
Burlington, Winooski----	28	---	---	12,330	---	232
Champlain, Winooski----	---	---	---	---	10,000	530
Black River, Ludlow-----	7	---	---	3,540	---	40
	35	---	---	15,870	10,000	762

KENTUCKY MILLS

	Cards		Combs	Spindles		Looms
	Woolen	Worsted		Woolen	Worsted	
Bradford Mills, Louisville--	---	15	---	---	14,360	---
Totals for all mills-----	748	409	436	279,284	549,242	9,715

While the plants making up the American Woolen Company are located in Maine, Rhode Island, New Hampshire, Connecticut, Vermont, New York and Kentucky, the number of woolen spindles in three of the Massachusetts units exceeds in total those in all the twenty-seven plants located outside this state, while in Lawrence alone approximately 375,000 worsted spindles out of the total of nearly 550,000 operated by the American Woolen Company are installed in the Washington, Wood, Ayer and Prospect Mills in the Essex County city.

The American Woolen Company had its inception in the mind of the late William M. Wood, who entered the counting room of the Wamsutta Mills, in New Bedford, when a mere boy, and three years later was placed in the manufacturing department.

Ambitious, restless, fond of adventure and action, he went from there to Philadelphia where for six months he was employed in a banker and broker's office, returning to New Bedford where he worked in a local banking house. But the lure of manufacturing led him back to the factory, and he became assistant treasurer and paymaster of the Grinnell Mills, in Fall River, and from there to the Border City Mills, in that city, where he served in a similar capacity for six years.

When the Washington Mills, in Lawrence were purchased by Frederick Ayer, of Lowell, he became assistant to the manager of that concern, and then selling agent, where his zeal, originality, and aggressiveness soon brought him to the management of this mammoth plant which was raised to a high degree of efficiency and prosperity. In 1899 he conceived the amalgamation of the original forty-nine mills, all but one of which was located in New England, into the American Woolen Company, of which gigantic corporation he became the first treasurer, and subsequently its president.

THE GREATEST TEXTILE DEVELOPMENT IN ALL HISTORY

The most significant development in the history of the corporation began at Andover, in 1918, when the Shawsheen Village project was launched. It is unrivalled in extent by that of any textile unit in all the world, and typifies the record of perseverance, energy and principle of its founder, the late William M. Wood, as can no other monument. At a period when pessimists prate of the alleged decline of Massachusetts and New England in the textile field it is pertinent to emphasize that no development, North or South, East or West, or in any foreign land, can be compared in magnitude, in facilities, in ease of production, in human relations factors and in completeness with the famous plant in Andover. When some other section of the United States is able to point to a unit comparable in extent it will then be time to rehearse the dirges that some people would love to hear sung over the remains of the unusually virile corpse which they erroneously believe today represents Massachusetts textiles.

The Homestead Association, which followed in 1919, formed for the purpose of affording employees of the American Woolen Company an opportunity to own their homes through the medium of monthly payments of an amount approximately equal to the rental; the offer of shares of common stock in the company to employees, with the result that 13,000 at once became part owners of the enterprise; together with the establishing of a labor department which has brought about harmonious relations between employer and employees, all emphasize the vision held by the founders of the American Woolen Company in their desire to create, foster, and maintain an economical agency for the production and distribution of woolen and worsted goods.

Not only is Shawsheen the center of the world's woolen and worsted industry, but from a geographical viewpoint it is the literal center of New England manufacturing industries, a fact which naturally arouses curiosity as to why the community happened to develop into such an important position in the manufacturing life of America.

In almost every other of the more than two hundred cities and towns in Massachusetts in which industries are located it "just happened" that some early settler, investor, or promoter chanced to find a potential water-power, or a conveniently located railroad artery, and there planted an industry, which, in its later development, became the dominant factor in the life of the community. But Shawsheen is peculiar in this respect, and totally unlike any other manufacturing locality in Massachusetts, or New England, in that it did not just happen. It was established as the result of wise, farsighted, business judgment, and it is favorably and conveniently situated with respect to its related industries because such a central location was sought and found.

Less than a dozen years ago Shawsheen Village in the town of Andover, was largely a stretch of sterile, unproductive terrain. Through it flowed the picturesque Shawsheen River, from which it derives its name, the stream emptying into the Merrimac, at Lawrence, a few miles farther north, where a fall of twenty-eight feet in less than half a mile led to the establishment there of what today is the largest worsted city in America.

For years the late William M. Wood gazed out from his Andover

estate, "Arden," and observed its handful of farmhouses at the crossroads, then known as Frye Village, and the idea of the future Shawsheen began to take form in his mind. As the years passed, the idea persisted, and then came the period to translate it into an actuality.

There were obstacles—hills, swamps, the perversity of owners of necessary acres, precedent and custom and even concerted objection—all requiring the exercise of patience, the spirit of compromise and conciliation, the establishment of good will, and even then the problem was not finished, as its solution involved engineering difficulties, architectural factors, road, sewer, water, and gas construction, and landscaping.

But eventually there emerged a scientifically and artistically planned village, the like of which exists nowhere else in this country, and perhaps with the exception of Port Sunlight, in England, in no other country on the globe. It instantly arrests the attention of all whose thoughts and activities are identified with civic projects.

Few communities have enjoyed so unified a purpose in their inception and development; few have had the advice of America's greatest construction geniuses, schooled in modern municipal problems.

Moreover, Shawsheen is a significant development, one of the most outstanding in modern industrial life. It is a demonstration that a business does not always have to accept conditions as they exist, and that it must accept them *per se*, no matter how non-productive and inefficient they may be. It is an example of creating conditions favorable to great efficiency, and enlarged production, and of more satisfactory and economical service to its customers.

The architectural queen of Shawsheen is the office building, of colonial design, of stone and brick, standing in the very heart of the new village, facing a terrace overlooking the banks of the Shawsheen River, with its picturesque, arched, stone bridge. Over its entrance appears the appropriate symbol of the spirit of the American Woolen Company's service to the world—the ram's head, and on the facade it appears again alternating with the American eagle and then with the Shawsheen Indian.

At the crossing of the main highway and Haverhill Street, stands the post office, surmounted by a handsome colonial tower and clock, the building also housing the community market, and offices on the second floor. Across the way is the garage, in architectural harmony with the other structures, and immediately to the south the laundry building, housed in a characteristic colonial structure. Just north of the garage is the attractive Shawsheen Manor, and the Merchants' Building.

On the west side of the main highway appear the more representative residences of the village, built of stone, brick, and wood, and set apart with spacious landscaped lawns and gardens. In harmony with the colonial theme of the village, appears the school building, and its fully-equipped gymnasium.

On the east side of the highway is the Balmoral Spa, a barber shop, a dance hall, suites of offices, and an outdoor dancing pavilion and bandstand. Across the river stands the creamery, and near it the Brush factory, while near the office building is the Shawsheen restaurant, with a capacity of 1,500 guests, and used also for dancing and moving pictures. On the lower floor are bowling alleys.

Just beyond stands the Shawsheen Mill—not only the last word in industrial construction, but beyond a doubt the finest textile plant in the

world. It is five stories high, with a basement, and houses the spinning and weaving departments. Adjoining it is the ten-story dyehouse and storehouse.

Nor has the recreational side of life been neglected at Shawsheen. A football gridiron, with ample seating capacity for spectators on rugged steel bleachers, numerous tennis courts, a baseball diamond, a swimming pool, a green for the ancient game of bowling, and a boys' club house, are provided.

Adjacent to the smoothly paved streets of the village are the more than two hundred colonial houses, individual in design, and with their well-kept lawns and gardens.

The capital stock has reached \$90,000,000, almost double the original investment of a quarter of a century ago, and the net profits have varied from \$2,000,000 to an almost \$16,000,000 a year, according to the fluctuations of the general movements of the market.

When in 1922, the average total wool clip of the United States was figured for the twelve preceding years, it was found to amount to 293,500,000 pounds per annum. Of that total, Boston bought sixty-four per cent, and she also handled sixty-three per cent of the wool imported into the United States from abroad during that period.

When it is recalled that in 1919 (the last United States Census figures available) more than fifty per cent of the woolen goods manufactured in the United States were produced in New England mills, and that their value was \$719,000,000, with their principal market west of New England, it can hardly be said that the more than 175 worsted and woolen yarn and cloth concerns which dot the Massachusetts landscape from Plymouth to North Adams and Pittsfield, and which exist in upwards of sixty cities and towns, played anything but a very important part in producing that staggering total.

In 1905, President Ayer resigned, became chairman of the board, and was succeeded as president by Mr. Wood. William H. Dwelly was chosen treasurer. The present officers are: president, Andrew G. Pierce; vice president, Frank H. Carpenter; second vice president, Wheaton Kittredge; third vice president, Parry C. Wiggin; treasurer, Wm. H. Dwelly; first assistant treasurer, Willard A. Currier; second assistant treasurer, Arthur P. Pousland; third assistant treasurer, Charles A. Hardy; fourth assistant treasurer, James G. Hill; clerk, Wm. H. Dwelly; assistant clerk, Frederick G. Sherman; directors, Andrew G. Pierce, Charles F. Ayer, Henry P. Binney, William L. S. Brayton, Frank H. Carpenter, Lester Watson, Ray Morris, A. H. Wiggin and Wheaton Kittredge; executive committee, Andrew G. Pierce, Frank H. Carpenter, and Henry P. Binney; comptroller, Parry C. Wiggin; general manager, Raymond S. Bartlett; selling agent, Charles H. Silver; manufacturing agent, J. Sime Mercer.

THE MURRAY COMPANY

The Murray Company was organized in December, 1899, by Milton E. Murray, who became president, E. Gracy Mander, vice president, and Frank P. Wakefield, treasurer. With several years' previous experience in the line to guide them, they began the manufacture of extracts, fruit juices and fruit syrups for the soda fountain trade, at 26 India Square.

Three years later the concern moved to larger quarters at 210 State Street, and thereafter, as expansion demanded, to 224-226 State Street,

and finally, in 1917, to the present location at 209-211 State Street. In this building of seven floors, all the Murray products are manufactured under most sanitary and modern methods.

Mr. Murray is in charge of sales and Mr. Mander is in charge of manufacturing. In 1920, Mr. Wakefield retired as treasurer, and was succeeded by George Y. Sawyer.

Fruit juices have now been almost wholly replaced by concentrated fruit syrups and prepared fruits of all kinds, and a full line of soda fountain sundries has been added to the products.

The Murray Company is one of the oldest and foremost companies in New England in its line, and practically the only concern that specializes exclusively in products for the soda fountain trade. It has always enjoyed an enviable reputation as a manufacturer of quality products.

The corporation has capital of \$100,000 and employs upwards of sixty persons.

THE DAHLQUIST MANUFACTURING COMPANY

Three decades ago Theodore W. Dahlquist, a practical metallurgical engineer and inventor, began the production of copper boilers on a small scale, and with limited capital.

Today, Mr. Dahlquist, who holds the office of president and treasurer of the Dahlquist Manufacturing Company which has capital of \$128,800, and which utilizes the services of seventy-five skilled men, is the presiding genius of a concern which has grown to occupy 36,000 square feet of manufacturing space, located on three floors of a new fireproof factory of concrete and steel. The plant is completely equipped with an elaborate system of elevators, overhead containers and automatic machine tools of the latest design.

A three-cylinder 180-horse-power Deisel engine is installed in the main power plant, with a 100-horse-power gas engine in reserve. Included in the equipment is a 30-ton press, which is used in forming the heads of the copper boilers.

From the beginning of the enterprise, Mr. Dahlquist has insisted upon quality production, and this factor, coupled with a consistent use of printers' ink, has resulted in making his products sought after by consumers desiring the best. The concern ranks today as one of the leading producers of copper boilers in the United States.

THE BADGER FIRE EXTINGUISHER COMPANY

The Badger Fire Extinguisher Company was founded about 1900, although the manufacture of fire extinguishers had begun several years previous to that time. The idea in mind which prompted the production of a hand fire extinguisher was conceived chiefly to fill a decided need for portable extinguishing devices, for general protection against small fires, and to add to the diversification of the copper-smithing business.

The first extinguisher made by the company was the 2½-gallon soda and acid type, which was developed and perfected by Arthur C. Badger, under whose direction the Badger Fire Extinguisher Company entered this field. The construction of extinguishers is classified as a technical specialty, and almost from the start they have been built under the close supervision and inspection of the Underwriters Laboratories.

During the past ten or fifteen years, the extinguisher industry has

broadened considerably and the Badger Fire Extinguisher Company has been one of the leaders in developing various types to meet the modern demands for fire protection devices. In addition to the small hand extinguisher, a forty-gallon hand-drawn chemical engine was developed, the construction of which included the use of the well-known Badger "lead lined tank." Next, came the different sizes of foam type extinguishers, the demand for which increased as the oil business became more prominent.

Practically all of the earlier types used a liquid that had to be protected from freezing, making it quite important that a non-freeze device be perfected and used in places where the extinguishers were subjected to low temperatures. Perhaps one of the most important developments in the entire extinguisher industry is the Badger forty-gallon, non-freeze chemical engine which has recently been placed on the market. This engine is the only one of its kind approved by the Underwriters Laboratories and the Factory Mutual Laboratories, and will operate as effectively at 40 degrees below zero as at higher temperatures.

While Badger fire extinguishers are manufactured in Boston, they are widely distributed in all parts of the world.

The president and treasurer of the company, Arthur C. Badger, who has been a manufacturer of copper products for many years foresees still greater opportunities for expansion in the industry through the development of even more effective devices for protection against fire.

Alexander H. Blackett is vice president and the corporation employs upwards of 30 men and women.

CHARLES H. TENNEY & CO.

On January 2, 1900, Charles H. Tenney and his associates, with a far look into the future, started that which was to become a tremendous force in the life of New England. On that date they assumed the management of the Malden Electric Company, of Malden, and immediately began putting into effect constructive policies toward a rendering of greater service to the public.

During the succeeding years, company after company has been brought under the management of that group of leaders and others who have joined Colonel Tenney in the march of his organization.

The slogan "Tenney Service" has been continually advocated, and the vision which Colonel Tenney had at the beginning of his public service career has brought to hundreds of thousands of homes a service which has continually increased their comfort and efficiency.

Since 1900 Tenney Service has grown from one company to 29; from assets of \$423,491 to \$87,864,346; from revenue of \$145,702 to \$20,931,542; from 31 employees to 3,100; from a payroll of \$30,241 to one of \$5,400,000; from four municipalities to 124; from one state to five, while the company's taxes of 1900 amounting to \$3,163, grew to \$1,958,687 in 1928.

Some companies have been taken over, reorganized and developed to a larger point of efficiency and service and then turned back to other interests. At the present Tenney Service includes the following corporations: American Tar Company, Beverly Gas and Electric Company, Brockton Gas Light Company, Concord Electric Company, Cinder Concrete Units Corporation, Exeter & Hampton Electric Company, Eastern Massachu-

setts Electric Company, Fitchburg Gas and Electric Light Company, Gloucester Electric Company, Haverhill Electric Company, Hampstead Properties Trust, Gas and Electric Real Estate Trust, Malden Electric Company, Malden & Melrose Gas Light Company, North Boston Lighting Properties, Oakland Power Company, Pike County Light and Power Company, Radnor Properties Trust, Rockland Electric Company, Rockland Light and Power Company, Salem Bricquette Company, Salem Electric Lighting Company, Salem Gas Light Company, Salem Terminal Corporation, Springfield Gas Light Company, Springfield Navigation Company, Shohola Power Company, Suburban Gas and Electric Company, and Teneco Sales Corporation.

Tenney Service puts into operation, through the relationship of Charles H. Tenney & Co., with the local companies, a most efficient management, engineering, accounting, and purchasing service, any division of which is also available to other companies desirous of having the coöperation of such an organization.

As consistently and as rapidly as possible in relation to sound business, both gas and electric rates have been reduced, and better methods of production and distribution have been adopted. This means that today in the territories served by the Tenney companies the public is receiving better service with less possibility of interruption, and at a lower rate than that in force in previous years.

In connection with the employees in the various companies working under Tenney Service, there has always been a very keen interest and a determination to provide those factors which would bring about the best interests of the workers. In each gas and electric light company the employees have their own Mutual Benefit Association conducted entirely by themselves, and they enjoy the privilege of life, sickness and accident insurance, and an annual physical examination—the expense being shared between the employee and the company. The meetings of these associations bring together most of the employees with a program of entertainment and worthwhile information, and it is interesting to note that in many of the companies, close to 100 per cent of the employees are taking advantage of all of the privileges offered, although it is optional whether they do so or not. Many worthwhile opportunities are offered to the employees, and the companies have ever been ready to coöperate in every possible way for those things which prove worthwhile in the lives of the men and women who serve the corporations and the public.

In 1924 Colonel Tenney purchased a considerable property at Canaan, N. H., and established Arvin Tavern as a vacation home for the employees of the various Tenney Companies. There, amid delightful surroundings, many spend their vacations and enjoy week-end trips with those features provided that go to make a vacation a time of rest and pleasure.

Believing that the public utility company has absolute responsibility to the public, Tenney Service has been continually looking ahead to evolve those measures of service which would bring to its customers the very best. At the same time, there has been a very careful scrutiny of the large investments required, and everything possible has been done to safeguard the interests of the many investors who have placed their money in the stocks of the various Tenney Corporations.

With a clear vision and a keen business insight, with a stern determi-

nation and a sympathetic human interest, there has been built successfully and well this organization that today renders such admirable service to the public.

Palmer York is president; Rockwell C. Tenney, treasurer, of Charles H. Tenney & Co., while Col. Charles H. Tenney is chairman of the board of directors, the others being Palmer York, Allen Hollis, A. B. Tenney, and D. E. Manson. Upwards of 300 men and women are employed by the concern, in the Boston headquarters.

THE HARDING UNIFORM & REGALIA CO.

In 1900 George F. Harding, who had been in the employ of the Continental Clothing House of Boston, as salesman for fifteen years, formed the Harding Uniform & Regalia Co., with a capital of \$2,000. The enterprise had three employees, and occupied a small room in the Continental Building, at the corner of Washington and Boylston streets. The venture prospered from the start, and in 1903 it removed to 211 Tremont Street, where manufacturing facilities and sufficient room to conduct the business were acquired.

In 1904 the Harding Uniform & Regalia Co. was incorporated with George F. Harding as president; Josie M. Harding as clerk, and Alvin Smith as treasurer, these three officials also constituting the board of directors. These executives have held the original offices continuously up to the present time.

The growth of the business demanded still larger quarters and in 1915 the plant was moved to 22 School Street, where three entire floors were occupied, and by which time the company had become known throughout New England as the largest manufacturers and dealers in its line, in the six northeastern states.

In 1917 and 1918, the years of the World War, and again in 1919, the year of the police strike in Boston, the business of the company increased beyond all expectations, the sales for these three years being approximately two and a half million dollars.

In 1917 Major Charles T. Harding and Robert E. Harding, sons of George F. Harding, were elected vice president and secretary respectively of the corporation and now hold these offices.

In 1925 the company moved to still larger quarters at 30 Franklin Street, where it is located at the present time.

THE NEW ENGLAND BRICK COMPANY

It remained for the twentieth century, and for a group of far-visioned New England men to furnish the genius which welded together in 1900, thirty-seven different brickyards located in Belmont, Cambridge, and Medford, and others in Maine, New Hampshire and Vermont, into the New England Brick Company.

As an example of New England efficiency it is interesting to note that by the consolidation between 1900 and 1920 of the thirty-seven yards into seven, the output is approximately the same as when all were in use. This has been accomplished by improved methods of production; by the installation of dryers, which permit brick to be manufactured twelve months of the year; and by the purchase and use of up-to-date automatic machinery, enabling eight bricks to be made where six

were previously produced. Every working day 400,000 bricks are produced at the seven yards, and are shipped throughout the United States.

The corporation has capital of \$316,000, and employs upwards of 500 men. Its Boston headquarters are at 185 Devonshire Street. A. F. Blanchard is president and W. G. Long is treasurer and secretary.

The effort of the management has been to improve the quality and production facilities, as well as to reduce the cost of manufacture, and experiments are constantly carried on in the drying and burning processes, thus enabling the corporation to produce at a low cost the finest brick made in the East. The Cambridge plant of brick and steel is one of the most modern of its kind in New England, and is equipped with the latest automatic machinery and dryers. The daily capacity of the five sand-struck plants is as follows: Cambridge, 135,000; Medford, 63,000; Belmont, 50,000; Epping, N. H., 50,000; Mechanicsville, N. Y., 100,000.

Two plants located at Goric, N. H., are operated from May to September each year, in producing the famous hand-made wood-burned water-struck brick. This process of manufacture, as old as civilization itself, is now nearly extinct, but as no machine yet devised has been able to duplicate the work of the human hand in the production of this type of commodity, the corporation has maintained this method because of the individuality attaching to the brick thus produced. The finest residences, apartment houses, colleges and public buildings demand brick made by the hand-method and the New England Brick Company ships the commodity throughout the United States.

CARL STOHN, INC.

Carl Stohn, Inc., was established in Hyde Park, in 1900, and was incorporated in 1921, with capital of \$435,000, to manufacture cotton and silk mixed fabrics for vests, corsets, robes and shoes.

The Hyde Park plant is equipped with 177 Jacquard and three plain looms, and employs 350 operatives.

Branch plants are operated at Charlotte, N. C., and Grandy, Province of Quebec, while sales offices are maintained in New York, Chicago, and Los Angeles, and in Montreal.

Alexander C. Stohn is president and superintendent; W. Sales, secretary, and F. A. Dakin, treasurer.

THE F. W. WEBB MANUFACTURING COMPANY

The F. W. Webb Manufacturing Company was founded in 1900, succeeding J. V. N. Stultz, who began business in 1866, and who became a member of the firm of Stultz & Mansur, in 1873.

In 1888 the Henry McShane Manufacturing Company purchased the business and operated it as the Boston branch of that concern, until Frank W. Webb, who had been the local manager, formed the new corporation. In 1912 a warehouse was opened at Charlestown; eight years later a branch was established at Lowell, and, in 1924, another was set up at Watertown, all having ample spur tracks. In 1926 a branch was opened at Roxbury. The company maintains its offices at 50 to 60 Elm Street, Boston, is capitalized for \$250,000 and employs approximately 100 persons in handling plumbing supplies of all kinds.

H. W. Thorndike is president and M. J. Morris, secretary and treasurer.

ADAMS, CUSHING & FOSTER, INC., AND THE MOORE PEN COMPANY

Adams, Cushing & Foster, Inc., and its predecessors, cover a period of over sixty years and during all of the time the various units have been engaged in both the wholesale and retail distribution of stationery and kindred lines. During that period the business has been operated in only three locations—Bromfield Street, Devonshire Street, and since 1920, at 110-114 Federal Street. During these three score years a direct financial relation in some manner has been maintained between the concerns that followed each other as the generation of younger men succeeded their elders and no one member of a partnership sold out to another or no one concern transferred to its successor without some partner, manager or group of employees following on in the work with the succeeding house. The active and vigorous men who hold the principal offices in the corporation, as it is constituted today, namely, W. F. Cushing, its treasurer; G. L. Davis, its president, and William H. Bigglestone, its vice president, have a combined total experience in the stationery business of 131 years.

From the present-day firm of Adams, Cushing & Foster, Inc., has grown the Moore Pen Company, and the origin of the latter corporation followed an attempt by a Boston musician, who was engaged in preparing a music score, to produce a fountain pen that could not leak, and that would cork like a bottle. Finding a great black blotch of ink in the center of the score that lay on his desk, he conceived the basic idea of a writing utensil that effected a revolutionary change in the fountain pen industry of this country.

It remained for more practical minds than his, however, to put into workable shape the crude invention which he produced after much labor. He succeeded in interesting Walter F. Cushing in the device, and under his able guidance and with the assistance of mechanical experts there emerged from obscurity and burst upon the horizon an epoch-making invention in the history of writing instruments—the Moore non-leakable fountain pen—the pioneer ink-tight, air-tight device, the first with a point which drew back into the bowl, and the first with a screw-on cap.

Upon its first appearance in 1900 the peculiar construction of the pen—so radically different from any other—subjected it to more or less unfavorable criticism from wiseacres in the fountain pen field. When in history have there not been “doubting Thomases” to cast aspersions upon a new invention—no matter how noteworthy?

But, as often happens, so vast was the superiority of the device to the leaky, scratchy fountain pens in general use at that time that the new commodity speedily won nation-wide popularity.

In view of the early criticism, it is interesting to recall that the principle of the screw-on cap, as perfected and patented for the Moore, has been copied and universally adopted, while the withdrawing point feature was also imitated in other makes of fountain pens.

In a little room in a Boylston Street building, a few machines were installed, and half a dozen skilled mechanics began the production of the new pen.

The growing demand necessitated the formation of a corporation—

The Moore Pen Company, and within a quarter of a century thereafter the product was sold throughout the civilized world.

To the original non-leakable model have been added a series of perfected lever self-filling pens of the most efficient type, an improved mechanical pencil, fountain pen inks, clips, neck ribbons, chains, beads, and the manufacture of the famous Moore-Miller gold pen nibs.

The Moore gold points have always been distinguished by their excellence, and to maintain this superiority The Moore Pen Company installed its own pen-making department, equipped with the latest and most improved machinery, manned by master craftsmen, and supervised by Thomas P. Miller, whose genius in gold pen-making has given him a national reputation.

The home of The Moore Pen Company is at 112-114 Federal Street, and is a modern office and factory building, carefully planned for maximum convenience and efficiency of operation, and equipped with every up-to-date appliance—passenger and freight elevators, departmental telephones, pneumatic tube system, sprinklers, burglar alarms, etc. The office and work rooms are arranged to secure an abundance of light, fresh air and comfortable working space.

On the second floor are the general executive offices, the sales, advertising and accounting departments, and the president's private office and conference room. The upper floors are occupied by the repair department, machine shops, gold pen department, assembling and inspection departments, general manufacturing work rooms, and shipping and storage rooms.

W. F. Cushing is treasurer and general manager; G. L. Davis, president; O. R. Smith, vice president; B. A. Newell, general superintendent; M. G. Sypher, production superintendent; T. P. Miller, superintendent of the gold pen manufacturing department; and C. K. Lovejoy, industrial engineer. The corporation has capital of \$125,000, and employs 125 operatives.

THE ROYAL CURTAIN MANUFACTURING COMPANY

In 1900 the first novelty curtain manufacturing company to be established in Boston, was formed when the Royal Curtain Manufacturing Company was established at 30 Kingston Street, by A. L. Gordon.

In less than a quarter of a century the Hub has become recognized by the trade as America's center for novelty curtains, another demonstration of the ability of Massachusetts industrialists to recognize a need, and to meet it promptly.

In 1905 H. O. Gordon became identified with the Royal Curtain Manufacturing Company and is now its president. The founder, A. L. Gordon, is still active in the affairs of the corporation, and is its treasurer.

In 1907 larger quarters became imperative, and the enterprise removed to 111 Summer Street, where it occupied 2,000 square feet of area, which later were increased to 8,000 square feet.

In 1920 the corporation erected at 283-285 Hyde Park Avenue, Boston, what is the largest and most modern curtain factory, in the Hub, containing 30,000 square feet of manufacturing area, in which 100 operatives are employed. The selling and executive offices are at 35 Kingston Street, Boston, and branch offices are maintained in New York, Chicago, Roanoke, Va., Buffalo and Los Angeles.

Within the past five years the concern has enlarged its production to include not only novelty curtains, but yard goods to march in harmony with the modernistic trend in fabrics, as well as heavy draperies, including damasks and taffetas. A branch factory, in Passaic, N. J., is operated where the weaving of these goods is carried on.

The corporation has capital of \$175,000.

THE MAGIC POWER OF AN INVENTIVE GENIUS OF MASSACHUSETTS—KING C. GILLETTE

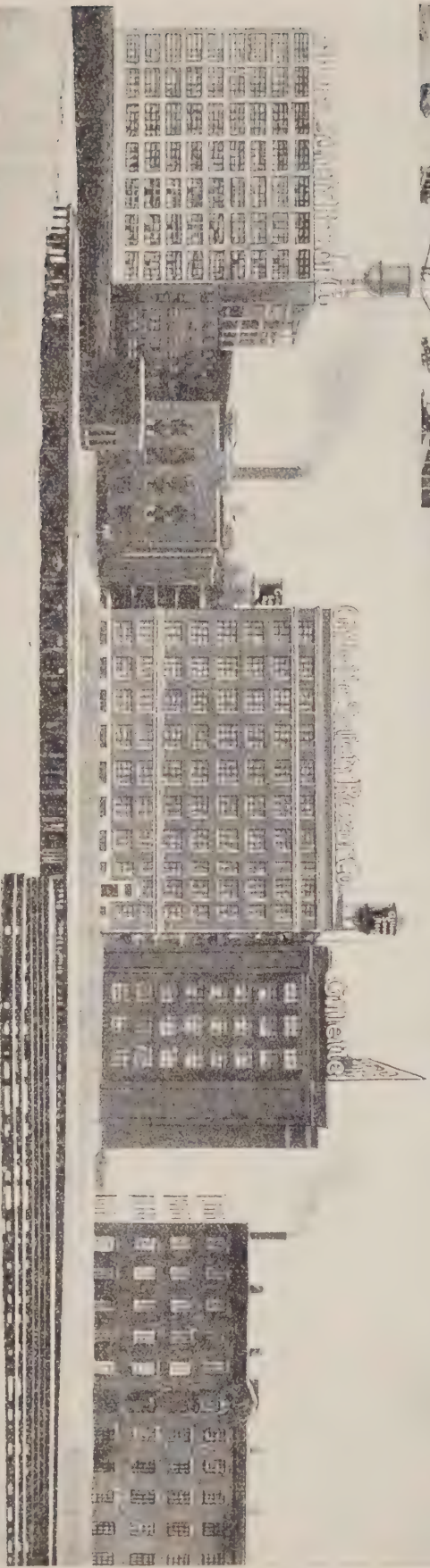
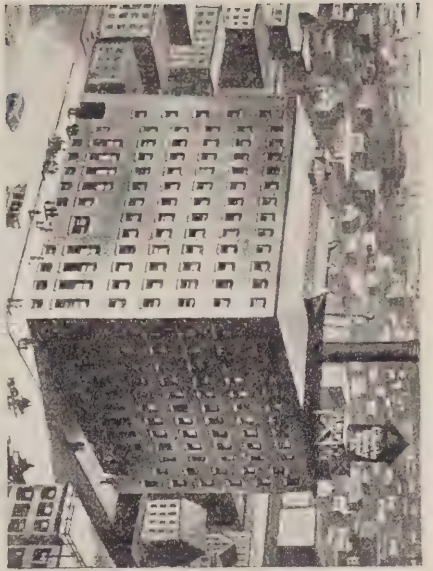
No invention of ancient, medieval or modern times has done so much in less than a score and half years to render Santa Claus the only universally loved bearded man as the invention of King C. Gillette's safety razor. Twenty years ago the harvest of the then existing crop began in dead earnest, and in the intervening period there has been no reseeded. It is impossible to evaluate the blessings flowing from this boon to mankind.

The change of fashion that eliminated the thickets of hirsute appendages from father's face renders it unnecessary for the innocent babe of today to peer through a fringe of oakum to learn whether dad is smiling, or preparing to bark, and now that 50 per cent of the comparative data, which constitutes the lower part of his face is no longer concealed by Burnside's age-old compliment that the new arrival strongly resembles his sire conveys more apparent honesty than was the case less than twenty-five years ago.

While the change has robbed the writers of fiction of one of their hoary commonplaces, in that they can no longer truthfully say that father "tore his whiskers in a rage," their vocabularies still carry allusions to his "mustache flurrying upward in a cyclone of wrath," although these sickly and inane facial adornments have become so insignificant in recent years as to resemble anaemic caterpillars.

It was in 1895 that Mr. Gillette, then a traveling salesman for the Baltimore Seal Company first gave consideration to the invention which, in less than a quarter of a century, following the formation of the company which bears his name, gave rise to an organization with branches or agencies in every civilized country in the world, and whose present distribution is circumscribed only by the boundaries of the earth. The impulse to invent was in his blood, his father and his brothers having many patented commodities to their credit. A chance remark made by William Painter, an executive of the Baltimore Seal Company and the inventor of the crown cork, which led to the formation of the Crown Cork & Seal Co., was in reality the genesis of the safety razor. He said to Mr. Gillette: "King, you are always thinking and inventing; why don't you try to create something like the 'Crown Cork' which, when used once, is thrown away and the customer comes back for more, and with every additional customer you get, you are building a permanent foundation of profit?"

For four long years, these words rang in King C. Gillette's ears, and he became obsessed with the idea that some day there would come to him a suggestion to apply Painter's thought to a material need. One morning, while at his home in Brookline, Gillette found his razor dull beyond the point of successful stropping, and as he stood before the mirror, with his eyes resting meditatively on the shaving utensil, the funda-



INSIDE AT TOP, CITY FACTORY SOUTH BOSTON FLOOR AREA 36,000 SQUARE FEET

mental conception of the safety razor came to him. Many unvoiced questions were asked and answered by him with the rapidity of a dream, rather than by the process of cold reasoning. He visualized the manner in which a flat blade could be adjusted in a holder; next came the idea of sharpening the opposite edges of a thin piece of steel, thus doubling its service, and, following in sequence, came the model of the handle equally disposed between the two edges of the blade.

He knew little about razors, and less about steel, and he could no more foresee the early trials and tribulations that were to flow in the wake of his day-dream before his invention would become a commercial success, than he could appreciate the fact that within a quarter of a century the blades manufactured at the Boston plant in a single month's time would, if laid end to end, provide a double-tracked railroad from the Hub to the Golden Gate.

THE FAITH THAT REMOVED NOT MOUNTAINS, BUT BEARDS

But he believed in the idea and he rejoiced in it. Writing to his wife, who was then visiting in Ohio, he said: "I have got it; our fortune is made," and drawing crude sketches he described a razor having the same fundamental principles that exist in the manufactured product of today.

That very day he went to Wilkinson's hardware store, on Washington treet, Boston, where he purchased some pieces of brass, some steel ribbon such as is used for clock springs, a small hand-vice, and some files. With these as his stock in trade, he fashioned the first crude model and prepared many sketches, some of which were later used as exhibits in patent suits, where they proved useful in establishing the priority and to some extent the scope of his invention.

Mr. Gillette's contribution to the mechanical world did not consist primarily in a particular form of blade or design of blade holder, but in the conception of a blade so cheap as to be discarded when dull. To secure such a type Mr. Gillette abandoned the forged blade; resorted to one fashioned of thin sheet steel which could be cut from a strip, thus avoiding the expense incident to forging and hollow grinding, and produced the "no honing—no stropping" idea, which is fundamental in the Gillette product and a complete reversal of the former practice.

Nobody but the inventor had any faith in a commodity, where a part was to be used and then thrown away. His friends told him this feature was beyond the bounds of reason, and they looked upon his model as a joke, but for five years he clung tenaciously to his theories, made a number of new models, with minor variations, and sought, through others, to secure blades with shaving qualities. The observations of technical men who knew most about cutlery in general, and razors in particular, were most discouraging, but he did not falter in his search for success, and he laid an enduring foundation upon which others might build the imposing superstructure that today characterizes the Gillette Safety Razor Company.

One of Mr. Gillette's acquaintances, Jacob Heilborn, engaged a skillful Swedish artisan, with machine-shop experience, who spent some time in experiments without important results, and then Heilborn consulted William E. Nickerson, a graduate of Massachusetts Institute of Technology, and a successful mechanic, who finally agreed to devote some of

his time to the problem of developing a razor, based on Mr. Gillette's idea of a flexible double-edge blade to be discarded when dull.

Then came the struggle to finance the company, which was incorporated on September 28, 1901, with paid-in capital of \$5,000, and an authorized issue of \$500,000. Later, Mr. Gillette received 17,400 shares; Mr. Nickerson, Mr. Heilborn, and Edward J. Stewart, 4,200 shares each, and, as Henry Sachs had been influential in placing the original 500-share blocks, from which the \$5,000 in cash came, Mr. Gillette allowed him 4,000 shares out of his own allotment.

Edward J. Stewart, of Brookline, one of the subscribers to an original 250-share block of stock, was in the bottling business. One day R. C. Flaccus, a Pittsburgh bottle manufacturer, called on him, and as an inducement to Mr. Stewart to buy some of his products, Mr. Flaccus agreed to purchase the 250 shares of razor stock, not setting a great value on it, but putting it away in his safe, where he promptly forgot it until four years later when Mr. Gillette found himself in pressing need of the shares, and paid Mr. Flaccus \$62,500 to obtain possession of the certificate.

WILLIAM E. NICKERSON PERFECTS THE INVENTION

The genius of Mr. Nickerson soon became apparent. To quote Mr. Gillette's own words, written in 1918: "I believe Mr. Nickerson, by luck or by providential design, was the only man in the world who could have perfected the razor, and our factory today in its machines and mechanism is testimony of the mechanical genius and resourcefulness of this remarkable man in overcoming obstacles, in arriving at simplicity and efficiency. I could not say too much about William E. Nickerson if I should write this whole article about him alone. The most marvelous fact of this wonderful man is his ability to construct in thought an intricate mechanism with hundreds of parts and many accurately-timed movements without drawing a line on paper until it is completed and operating in his mind, and when the machine materializes it works as he saw it working with his mind's eye."

On giving the problem serious thought, Mr. Nickerson began to discover the proper procedure and felt that he could develop the razor into a commercial proposition. The parts took definite shape in his mind. He visualized the hardening process and the sharpening machines, and very definite ideas were evolved as to the type of handle necessary to properly hold the blade.

Hardening apparatus and sharpening machines could not be properly designed until the form and size of the blade were known. Therefore the first step was to decide how the blade and the handle were to be formed. Mr. Gillette's models were sufficiently developed to disclose the fundamental ideas, but there was left a wide range of choice in the matter of carrying them out, and furthermore, the commercial success of the razor was sure to depend very much upon the judgment used in selecting just the right form and thickness of blade and the best construction in the handle.

Mr. Nickerson's fundamental thought in relation to the remodeled razor was that the handle must have sufficient stability to make possible great accuracy of adjustment between the edge of the blade and the protecting guard. The Gillette handle is made to micrometric dimen-

sions and is an extremely accurate instrument. If damaged or thrown out of alignment, poor shaves are likely to result. This idea of stability led Mr. Nickerson to design a handle to be "machined" out of solid metal, in contradistinction to one stamped from relatively thin sheet metal. To this fact much of the commercial success of the invention is due.

The shape and thickness of the blade were next determined by Nickerson. He reached the conclusion that sheet steel thinner than six one-thousandths of an inch appeared to lack sufficient firmness to make a good blade, while a thickness greater than that seemed too difficult to flex readily; consequently he chose a blade six-thousandths of an inch thick. In the matter of width, one inch was thought by him to be unnecessarily wide and three-quarters of an inch was found to be too narrow, especially when flexing was considered. Thus seven-eighths of an inch was adopted. As to contour, a circle one and three-quarters inches in diameter if symmetrically crossed by two parallel lines seven-eighths of an inch apart gave chords corresponding to the cutting edges, one and one-half inches long, which was thought to be the right length for the edges. The rounded ends of the blade form thus produced strengthened the blade along the center where the holes were to be located and gave the blade its well-known shape. After twenty-five years of use nothing has transpired to cause regret that some other shape of blade was not selected. These early decisions were of the utmost importance and almost seemed inspired.

On September 9, 1901, Mr. Nickerson sent a report of his findings and recommendations to Mr. Heilborn, and his conclusions being approved, he was commissioned to design a machine for sharpening the blades, and another for hardening the blades in packs.

Soon afterwards development work was started in the machine shop of Edwin E. Bartlett, a friend of Mr. Nickerson, at 394 Atlantic Avenue, Boston; where the first hardening apparatus and sharpening machine were built.

LAYING THE FOUNDATIONS OF FUTURE SUCCESS

During the first two years of the history of the original corporation (1901-02), the sales chart shows that no attempt was made to market the product. They were the years of perfecting, and building on a stable foundation, in order that no attempt would be made to foist upon the public an imperfect commodity.

The perfecting of the razor brought up the question of marketing and it was decided to place this branch of the business in the hands of others with more experience in this line. Accordingly, an exclusive contract was made with two young men, Messrs. Townsend and Hunt, whereby the Gillette Company was to receive a fixed price for the razor and blades, and confine itself to manufacturing.

Opening an office in Chicago, later moving to New York, under the name of the Gillette Sales Company, on \$3,000 borrowed capital, these young men without additional financial assistance, took care of all advertising and sales expense incidental to the marketing of the razor. Three years later when the Gillette Company decided that it should control every phase of the business, they sold their sales rights to the concern for \$300,000.

In 1903 fifty-one razors were sold, and fourteen dozen extra blades were disposed of; in 1904, the year Mr. Gillette received his patent, 90,844 razors were marketed, and 10,304 extra dozen blades were sold; the next year the totals rose to 276,577 razors, and 98,909 extra dozens of blades, and in 1906, 306,815 razors, and 444,457 extra dozens of blades were sold.

A youthful Buffalo attorney drew up the contract between Townsend and Hunt, and the Gillette Safety Razor Company, and had become vice president of the Gillette Sales Company. His vision caused him to abandon his private practice and concentrate his energies in promoting sales for Townsend and Hunt.

When this firm was bought by the Gillette people, this young man, Thomas W. Pelham, was selected as president of the Gillette Sales Company, the subsidiary formed by the Gillette Safety Razor Company to merchandise the razor. The impressive growth of Gillette during the time he was president of the Sales Company, and later, when the subsidiary was consolidated with the Gillette Safety Razor Company and Mr. Pelham was made sales director, up to the present day, has been accomplished by Mr. Pelham's efforts and through his guidance.

For the first two years the company's stock had practically no value, any offer from 25 cents to \$1 resulting in a change in ownership of the shares. In times of financial stress in its affairs during this formative period of its history even futile attempts were made to pay for raw material with shares in the company, with refusals in the majority of cases.

In the financial districts offers of 25 cents a share for the stock usually found the holder anxious to sell at that price.

After the first two or three years, and when the outlook began to brighten, the shares increased in value perceptibly and in 1903 offers of \$2.50 a share found few willing to part with their Gillette investment.

To compensate Mr. Gillette for the foreign patents which the company purchased from him, the capital stock was increased on October 6, 1902, from 50,000 to 65,000 shares, and on June 1, 1912, the charter was changed to a Massachusetts corporation, and the capitalization increased to \$6,500,000 common stock, and \$6,500,000 7% preferred stock. The shareholders of the Maine corporation were given one share of common stock and one share of preferred stock of the Massachusetts corporation, for each share of the former.

Up to 1917 the controlling interest in the stock was held by Messrs. John Joyce and Maurice J. Curran, but upon the former's death in 1917, this control was purchased by Messrs. Aldred & Co., of New York.

On September 20, 1917, the company was reorganized under the laws of Delaware, with a capitalization of 250,000 shares, no par value stock, and \$6,000,000 6% 5-year notes, the latter being convertible into stock at the rate of one share of stock for each \$100 worth of notes.

Stockholders of the Massachusetts corporation received three shares of stock in the Delaware corporation for each share held. The preferred stock of the Massachusetts corporation had been previously retired. The \$6,000,000 6% 5-year notes of the Delaware corporation were either converted into stock or repurchased by the company before the end of 1919.

In 1917 the management granted Gillette employees the privilege to subscribe to stock in the new corporation on a partial payment plan.

Stockholders of record on January 30, 1920, were offered the right to subscribe for one new share of stock at \$97.50 for every ten shares held, and on November 18, 1921, the capital stock was increased from 250,000 shares to 500,000 shares, and on December 19, 1921, a stock dividend of 10 per cent was paid and stock dividends of 5 per cent were declared on June 1, 1922, December 1, 1922, June 1, 1923, December 1, 1923, and June 1, 1924.

On December 1, 1924, a stock dividend of 470 per cent was paid, increasing the capital stock from 500,000 shares, of no par value, to 2,000,000 shares, of no par value, and on December 1, 1928, the company paid a stock dividend of 5 per cent.

It is of particular interest to compare the value of Gillette shares of September, 1917, to their value in 1928. One hundred shares of Gillette stock purchased at that time for \$8,000—or \$80 per share—had a market value of \$87,246 on September 20, 1928, an increase of 990 per cent.

Since the first dividend was declared in 1906 no dividend has been passed. During the period between the formation of the company and September 20, 1928, the company earned \$120,387,035 and paid to its shareholders \$60,983,562.

THE REWARD OF THE PATIENT INVESTOR—OR HOW WE MAKE MILLIONAIRES IN BOSTON

A Boston statistician with a nimble pencil has made an exact calculation of the appreciation in a \$250 Gillette Safety Razor investment, made in 1904. Starting that year with 500 shares of stock, which could have been purchased at 50 cents a share, or \$250, he assumes that the investor exercised his subscription rights and that when stock dividends were paid he purchased enough fractions to make an additional full share. The only subscription he would have had to make was for 150 shares at 97½¢, or \$14,625, and the cost of the necessary fractions would have been \$842.55, making a total investment of \$15,717.55.

On the other side of the account he would have received \$62,500 in redemption of 500 shares preferred stock at \$125, which had been given him free as part of the basis of exchange of stock of the original Maine corporation for that of the Massachusetts corporation. His cash dividends would have totaled \$281,986 and he would have at the present time (1929), 13,224 shares of stock worth at the 1929 high of 126¾¢, \$1,676,141.

Following is a recapitulation of the experience and it might be observed in passing that there are holders of Gillette stock who have actually held tight to their investment all these years:

Sale of preferred stock	\$ 62,500.00
Total cost of all stock	15,717.55
Excess over capital invested	46,782.45
Dividends	281,986.00
Return on investment	328,768.45
Market value of 13,224 shares	1,676,141.00

Progressive policies, combined with wise conservatism, as instituted by the board of directors and active management, has guided the com-

pany through every world-wide financial and industrial crisis and has built it up to the position of leadership which it occupies today.

SELLING GILLETTES TO THE WORLD

Its sales history is both an inspiration and an object of admiration.

From \$30 to more than \$200,000,000, from one room to several factories, from fifty-one razors in 1903 to 100,000,000 in 1928!

Step into a bazaar at Calcutta, enter a store in the northernmost town in the world, travel through the most inaccessible villages of Egypt, or if your wanderings take you through the Straits Settlements, or to some precariously perched town high up in the Alps, just as readily as you would walk into the shop of your favorite dealers in New York, London, Paris, Hamburg, Hong Kong, Havana or Buenos Aires, Gillette users in these places may purchase their periodical supply of these blades as easily as you buy them.

It is impossible to name any other manufactured commodity with a distribution as great and as widespread as Gillette. Admittedly the peer of other manufacturers in world-wide distribution, Gillette presents an astounding record of sales building.

This widespread market was only won, however, through intensive, never-ending work, grim determination, and the genius of sales direction which has surmounted every obstacle.

It was in 1905 that the first foreign branch was opened, in London. Then followed the invasion of France, Germany, Austria, Scandinavia, and Italy, before the end of 1906, followed by all other European countries, as well as Asia, the Far East, and South America, until in 1924, there remained no known country on the globe that Gillette had not invaded.

An incident of the drive for foreign business is of interest. In the commercial conquest of Russia, Mr. Pelham traveled in the early part of 1915 with six tons of razors as personal baggage. Peasants' carts were obtained to carry the merchandise to the Russian frontier, ferry boats conveyed the goods to the Finnish town of Tornea, and the Finnish railroad completed the shipment and transported it to Petrograd. Later, tons of both razors and blades were sent over the same route by first-class registered mail. Was it vision or chance that enabled this company to make such shipments? Other equally strategic methods were resorted to in order to send shipments abroad when shipping space was at a premium. Many a captain's cabin and crew's cargo space was filled with Gillette razors. When the period of depreciated currency followed, the condition was met by supplying merchandise in the restricted countries at as near war prices as possible, but yet under such control as to prevent the purchase of goods in one country where currency was depreciating and shipping them to another whose currency was higher.

Since 1917 the growth of the company has been remarkable, the intensive cultivation of both the retail and the jobbing trade constituting a contributing factor. During 1918, 3,500,000 razors and 365,000,000 blades were furnished to the Government for the boys in the service.

THE COMPANY'S DEMISE, LIKE THAT OF MARK TWAIN, WAS EXAGGERATED

Along in 1920 came rumors that the downfall of the company was imminent. The patents on the original razor were expiring in 1921. Manufacturers of cheap imitation sets were preparing to flood the market with

their products, and the public became interested in the results. The Gillette Company apparently was facing a crisis. It was, indeed, a critical period but one in which the most glorious pages of its history were written.

The new improved razor was formally introduced at a special salesmen's convention, in April, 1921, which was followed by a \$2,000,000 advertising campaign, with the result that the company emerged triumphant and is marching on to even greater heights today.

It has invaded other fields of production, having invented the Gillette wire and textile edge, which has eliminated the human element as a factor in pile cutting of Wilton and tapestry rugs and carpetings, and the Gillette surgical knife, which is now universally used by surgeons.

The executives of the company regard every man and woman in the world as a prospect for a Gillette razor, the female of the species having become large buyers within the past ten years, having adopted the razor as an aid to beauty. During the first twenty-five years of the existence of the company more than 53,000,000 razors were sold. The immediate potential razor population of the world is in excess of 800,000,000, therefore something like twenty times twenty-five years would have to pass before anything approaching the saturation point would be reached, and, in addition, it must be recalled that each year millions of young men become of shaving age. The market for Gillette blades is beyond computation or imagination. Nor can the statistician estimate the economic contribution made to society by two Massachusetts men, King C. Gillette and William E. Nickerson.

In the old days millions of men were slaves to the barbers; they resorted to shops once every day; they wasted uncounted hours in tonsorial chairs, and they paid in the aggregate enormous sums for service. The coming of the safety razor was an emancipation proclamation to mankind.

Measured in terms of hours saved it is undoubtedly true that no product has been devised since the dawn of civilization which has so materially added to the hours available for constructive effort on the part of those who previously were subject to the caprice and whims of tonsorialists, or to the annoying delays incident to the sharpening and honing of the old-fashioned razor, as this hand-servant of mankind.

Experts estimate that every razor sold by the company represents a saving of half an hour of time spent in a barber shop, with no recognition of the amount of money paid for service, or given by way of tips. If only forty million of the fifty-four million owners of Gillettes use them daily—and this seems to be a conservative estimate—this would represent a saving of twenty million hours per day, which could be devoted to gainful labor, study or recreation. This time is equivalent to 2,500,000 working days of eight hours, or the labor of more than 8,000 men constantly employed, and if their average wage should be assumed to be \$5 per day, the figure represents a saving of upwards of \$40,000 a day, or for a year of 300 working days, a gain of labor equivalent to more than \$12,000,000.

Study a group of men today, and you will fail to find one in ten wearing a Vandyke, a Mormon underslung pompadour, or a pair of windbreakers, carefully parted in the middle. Nor will you observe a duet of Burnsides, a specimen of the luxurious Lord Dundreary's, nor even

a duplication of the famous Smith Brothers cough drop-type. All of these are practically non-existent on men under middle age, and even where they exist they single out the wearer as the exception, rather than the rule. And it all comes back to the gospel enunciated by King C. Gillette.

AN EXAMPLE OF MASSACHUSETTS EFFICIENCY

Through improvements in processes and machinery the Gillette Company is today securing five times the output of product that it manufactured in 1909, a condition of efficiency which is not approached in any other industry in the world, and which is but added evidence that in Massachusetts there exist just as conspicuous examples of industrial progress and advancement as are observed in the mass production methods of the Middle Western automobile concerns.

To accomplish this result the Gillette Company rubbed no mythical Aladdin's Lamp, but it drew upon the magic power and the inventive genius of the human mind to give birth to methods of greater efficiency and economy.

Through automatic machinery and methods of mass production, Gillette has made remarkable strides in manufacturing. Whereas a dozen years ago it took 713 employees to produce 4,000 razors and 300,000 blades a day, it now requires 1,187 employees to produce 27,000 razors and 2,000,000 blades daily.

It takes three weeks to make a Gillette blade; 114 operations enter into its manufacture; and each day the company manufactures ninety-five miles of shaving edge. Back in 1904 Gillette used 383 pounds of blade steel; in 1917, 357,000 pounds were used, and in 1928 there were utilized approximately 1,895,700 pounds.

The Boston plant, which, in 1904, consisted of 6,000 square feet of floor space, today utilizes 588,400 square feet of area, while the Montreal factory contains 62,575 square feet of floor space.

On the occasion of the silver jubilee of the company in 1926, Frank J. Fahey, vice president and general manager, epitomized the phenomenal success of this great corporation in these words:

"The Gillette Safety Razor Company is in many respects one of the most remarkable industrial developments of New England. Beginning in Boston, a quarter of a century ago, with a new idea, with New England capital and under the guidance of New England people, its business has extended to the far corners of the earth.

By virtue of its expansion in foreign fields, the company's management has the most intimate contact with business and trade conditions, not in America only, but throughout the entire world.

"The Company's Silver Jubilee was the occasion for New Englanders to point with pride to such great progress, particularly now when so much is heard about the supposed decadence of New England industry.

"Gillette sowed its seeds in foreign fields twenty years ago when its representatives sold Gillette razors and blades the world over. Today the name 'Gillette' is as well known in Bombay as in Boston.

"The company has been one of the most consistent advertisers throughout the world for the past eighteen years and during that time millions of dollars have been spent, from current funds, to secure and maintain good-will for Gillette products.

"A world traveller, recently returned, said the Ford car, the Gillette

razor and the Singer sewing machine were the three best known American articles observed on his trip. He stated that although he used neither an automobile nor a sewing machine on his trip, his Gillette razor was in daily use.

POTENTIAL MARKET FOR 730,000,000 RAZORS

"The company's statistical department estimates the world market for Gillette razors at 800,000,000.

"The company has sold 70,000,000 razors (1926) leaving a tremendous potentiality.

"The number of young men annually reaching the shaving age runs into millions; each of these individuals is a safety razor possibility. In addition, there are the women who have become factors of no small importance in our company's distribution.

"The company has sold three-and-one-half billion blades (more than 4,500,000,000 at the end of 1928. Of this amount almost six hundred million were sold in 1926.

"Astounding figures!!

"Today, with its tremendous distribution through its agents, Gillette practically dominates the safety razor business of the world.

"The company has seen competitors begin business both here and abroad during the years of its existence, but it has continued an unabated development.

"The management learns occasionally of some competitor who has sprung up in England, Germany or elsewhere, supposedly to destroy Gillette's business to his own advantage.

"While his advertising, circular letters, etc., are being broadcast he is making desperate efforts (as happened recently) to have Gillette purchase his company.

"Consolidations, purchases of competitors' business, etc., have played no part in the Gillette Company's plan of success.

"The company's growth during the past twenty-five years has been effected, not through consolidations, but by constant, intelligent adherence of the management to the principle of an excellent product, good advertising and sound merchandising.

SHAREHOLDERS GET HALF OF \$100,000,000 EARNINGS

"From an original capital investment of \$5,000, the company has earned for its shareholders almost \$100,000,000.

"For twenty years the company's earnings have practically never failed to show increases over previous years.

"Of these earnings the shareholders have received about \$50,000,000 in dividends and the remainder has been carefully reinvested in the company's further development.

"For twenty years—with two unimportant exceptions—1912 and 1916—the company's dividend rates have increased each year.

"Its shareholders own the business; no bonds, notes or preferred shares rank ahead of them.

"The company's earnings in 1926, after reserves for taxes, depreciation, etc., were \$13,311,000. These compare with \$12,089,000 in 1925 and \$10,122,000 in 1924.

"A glance over its balance sheet at the close of 1926 shows \$50,000,000

of assets. Against this are current obligations of only \$64,000. Truly a remarkable set of figures!

"The company keeps on hand a liquid cash balance of \$5,000,000 to \$7,000,000.

"Its investments in securities have a market value of \$400,000 to \$500,000 in excess of their book value.

"The cost of its real estate, buildings, machinery and equipment—representing many millions of dollars—has always been paid from current funds and with no need of financing. These have been well depreciated and stand on the company's books now at figures far below their replacement value.

"The company's plants at Boston, Montreal and Slough, England, are models of efficiency and the machinery for the handling of its products is extremely ingenious. This machinery is solely for the Gillette Company's purpose and is protected by broad basic patents.

"The company surrounds its employees with every possible safeguard. Its operatives work in the newest and most up-to-date factory buildings in New England. Its insurance rate is among the lowest in New England.

"The company's labor turnover is very small and the management is fortunate in the high-grade, satisfied employees who assist in the company's operations.

"Many of these employees are shareholders in the company.

"The company's wage system for employees is based on a reward for individual effort and the results have proved very pleasing to both employer and employee.

DAILY CAPACITY 118 MILES OF SHAVING EDGE

"The company's daily productive capacity is 150,000 razors and 2,500,000 blades. This means that more than one hundred and eighteen miles of shaving edge is produced daily.

"There are six inspectors to each ten blade operatives and extra wages are paid for high quality of output rather than for quantity.

"The quality of the Gillette blade is today better than at any other time in the company's history and the management is constantly endeavoring to make still further improvement.

"Of the very few blade complaints received we find nearly every one is due to the user's razor being damaged, thereby throwing the blade out of alignment for shaving.

"Whenever such a case is discovered the company is glad of the opportunity to put the razor in perfect condition, without charge to the user, and, if necessary, supply him with another Gillette razor for use while repairs are being made.

"Some years ago the company spent several hundred thousand dollars to have its factory experts travel from Portland, Maine to Portland, Oregon, and from Canada to the Gulf to personally interview the trade and the users. These experts visited all the large cities and invited complaints. At the end of the service campaign the company collected thirty-one large packing cases of damaged (and in some cases almost worn-out) razors from which users were trying to get satisfactory shaves. The company replaced each damaged part without cost to the user. Some of these razors had given service for fifteen or more years.

THE BASIS OF GILLETTE SUCCESS

"If we were asked to state the factors that have brought the company success we would give the following:

1. An article of world merit and quality.
2. Sound financing.
3. Able management, which includes mechanical ingenuity, and sound merchandising.
4. A courageous, yet conservative board of officers.

"And with all its growth throughout the year Gillette remains a New England institution, controlled by New England capital, operated by New England people whose activities result to the benefit of New England.

"This is the brief story of one New England enterprise and we shall feel happy if it points the way to those who think they see New England's supremacy and productive capacity being swept off the commercial maps of our country.

"It should also inspire New England manufacturers with that spirit of commercial enterprise which prompted the forefathers to carry New England products to all the countries of the world and helped make Boston and New England famous in the annals of history.

"We agree with Henry Ford's advice:

"'Work hard and New England will take care of itself.'"

THE SALES BROKE ALL RECORDS IN 1928

In 1928 the company's sales, both in the United States and abroad, broke all records, one in every three of its sales being in foreign countries. The company had before the end of 1928 orders for delivery in 1929 for half as many razors as it had capacity to produce in the former year. Delivery of one lot of 6,000,000 razors began January 1, 1929, of which total 90 per cent were for use in Europe and the remainder in the Far East, thus leaving the whole of four of the six continents in the world to be supplied. In the fall of 1928, an order was received from Germany for 500,000 razors, with an option by the buyer to increase the total to 1,000,000.

In one year, 1926, through one operation alone, 1,000,000 Gillette razors were sold in Australia and 250,000 in New Zealand, and in the following year, sales of blades in these two countries increased 19 per cent.

It may be that there are manufacturing units in the United States whose careers are comparable to that of Gillette, but it is a matter of pride to the citizens of Massachusetts to observe that since the reorganization of this corporation in 1917, it has paid \$54,900,948 in cash dividends to its stockholders, plus stock dividends of 700 per cent, while its net income has shown an average annual increase of 10 per cent during this period, and the indicated market value of its shares was sixteen times greater, in 1928, than it was in 1917.

One need not go out of Massachusetts to find an adequate return upon invested capital, as the figures indicate that 100 shares of Gillette stock, purchased on September 20, 1917, would have cost \$8,000, and that exactly eleven years later, or on September 20, 1928, these same shares had a market value of \$87,246, an increase of 990 per cent. The vision of the company's executives is attested by the fact that 35 per cent of

the total business in 1928 was done in foreign countries, and that this amount exceeded the total domestic and foreign business of the company of 1917, and also exceeds the total domestic and foreign trade of the corporation from 1901 to 1913 combined.

Branches or agencies are operated in forty-six foreign countries.

The Canadian company, formed in 1906, has \$5,000,000 capital and surplus of \$3,000,000. It is under the general supervision of the parent company in Boston, which owns all its shares, these being estimated to be worth \$20,000,000 to Gillette. Besides doing a good business, the Canadian subsidiary is looked upon as a factor of safety. If for any reason circumstances should prevent the operation of the Boston plant, the Canadian factory would continue to function and supply demands for Gillette products.

In addition to its domestic business, taken care of from the Montreal plant, Canada has a differential in duty with the rest of the British colonies that enables her to supply goods to Australia, South Africa, New Zealand and India at duty rates much lower than these countries could be supplied from America.

Australia, a large country, although thinly populated, bought 1,250,000 razors in 1927 and 1,000,000 packets of blades in the first ten months of 1928.

In Germany, where Gillette was kept out for ten years, the first four because of the war and the next six because of restriction on imports, the company has now established a fair business, which is running at the rate of \$1,000,000 a year, and the prospects are that the company will transact business there of more than \$5,000,000 a year in the near future.

The British plant, at Slough, built to take care of a certain situation in England, has become a factor of considerable importance in Gillette's general distribution. Here the company manufactures 22,000 razors a day, and gives the English people a British-made article and places them, in that respect, in an advantageous position by not having to pay duties on razors.

All the company's factories are of sufficient size to handle a 50 per cent increase in business, without material capital expenditures.

SOME STARTLING STATISTICS

Such is the story of the Gillette Safety Razor Company which began operations, in 6,000 square feet of area, on the top floor of the building, at 394 Atlantic Avenue, in 1901, with paid in capital of \$30, one sharpening device and a few other machines, with a nominal capital investment of \$5,000 a few months later, and which has developed into an international institution, with capital and surplus in excess of \$48,000,000; whose aggregate sales increased from about \$250 in 1903 to more than \$35,000,000 in 1928; whose net earnings rose from \$408,898, in 1906, to \$16,244,429, in 1928, after ample reserves for taxes, depreciation, and all proper charges against operations, or \$8.12 a share on the 2,000,000 shares of stock, then outstanding, which had a market value at the high figure of 1929 (\$126 $\frac{3}{4}$) attained at the time this story was prepared, of \$266,175,000; whose plants and warehouses now occupy more than sixteen acres of floor space, having grown between 1917 and 1929 from 165,000 square feet; whose stockholders originally numbering three, and but

twenty at the end of 1901, when a score of men hazarded \$250 each, and received certificates for 500 shares of stock apiece to more than 11,000 today; whose unbroken dividend record since 1906 had given the stockholders up to the end of 1928 \$63,482,430 in cash, and 510 per cent in stock dividends, the cash distribution in 1906 being \$130,000, that in 1919, \$1,810,000, and that in 1928, \$9,995,745, plus a 5 per cent stock dividend, and whose total earnings over this period to September 30, 1928, were \$120,795,755, these figures to and including 1923 being computed before taxes reserves, etc., but subsequently these deductions were provided for; whose annual average increase in net earnings between 1917 and 1927 was 10 per cent, with payments to its stockholders from 1927 to 1928 inclusive, amounting to \$54,900,948 in cash, and 700 per cent in stock dividends; whose bad debts in 1928 were but \$12,025, and for the five years previous averaged but \$19,381; whose investments are considerably in excess of the amounts carried on the books; whose business is diversified products such as Gillette carpet wire and textile edges, surgical instruments, chiropodists' knives and chisels, office knives and twine cutters is gradually increasing and becoming an important part of the company's output; whose continued development of automatic machinery and the consequent elimination of manually performed operations has effected substantial savings in the payroll and in the cost of production; whose employees increased from a half dozen to 2,500 at present; whose foreign razor orders for 1929 equalled half of the company's entire output in 1928; whose small and comparatively negligible distribution of razors and blades in 1901 has grown to such an extent that the only man in history, ancient or modern, whose picture and autograph are found in every city and town, in every country of the world, is King C. Gillette, about whom there is not today and there never has been *another* man or woman that such a statement can be made; and whose aggressive merchandizing policy and its unlimited potential markets assures the development of this Massachusetts industry, now "known the world over" to even greater heights than even its phenomenal past indicates.

This Massachusetts company may well be described as a trail blazer that changed the habits and the customs of centuries, and improved the personal appearance of men in all climes.

The present officers are:

King C. Gillette, president; J. E. Aldred, chairman of the board; Frank J. Fahey, vice president and general manager; William E. Nickerson, Thomas W. Pelham and Ralph E. Thompson, vice presidents; William J. McCarthy, treasurer; F. G. Flynn, secretary, and J. J. DeCoursey, assistant secretary.

THE SKINNER ORGAN COMPANY

The discovery by a blow-boy that the hinge of an entire fold of a church organ bellows was the cause of the failure of the instrument to function, coupled with permission granted by the organist which enabled the youngster to step inside the organ and study its mechanism, resulted in giving the world what most authorities agree are America's finest and most famous instruments—the Skinner organs.

From that day forward the life work of Ernest M. Skinner was determined. The father of the young man was acquainted with George H.

Ryder, a small organ builder, in Reading, to whom Skinner was apprenticed. After sweeping the shop he was assigned to winding "trackers," and soon he contrived a hand-operated machine, which did the work at about twice the ordinary speed. Interested in the voicing of the organ, which was remote from any possible contact with his original work, young Skinner finally manoeuvred so as to become a helper to Mr. Ryder's voicer and tuner. Desiring to learn the theory of setting a temperament, he was informed that it was a secret, but a friend of the young man, employed in Samuel Pierce's nearby organ factory, told Skinner to "sharpen the fourths" and "flatten the fifths"—this information constituting all the instruction the young man ever had in the art of tuning. Buying a piano hammer, he practiced on his father's piano to the extent of putting it out of tune, and he searched for tuning methods and possibilities whenever and wherever possible.

During the few years that he was a tuner exclusively he set temperaments on every stop, including every rank of mixtures and by ignoring the octave and using the fourth and fifth only he developed speed and accuracy, and became responsible for the present method of tuning throughout by "fourths and fifths," many expert tuners having adopted this policy through Skinner's influence and instruction.

Remaining with Ryder for four years, he became a tuner for George S. Hutchings, of Boston, and later for Jesse Woodberry, of the same city. Returning to the employ of Hutchings, he was given his first real opportunity in organ building as a draughtsman, remaining with him for twelve years and developing the tubular and electric actions used by his employer.

It was here that J. Montgomery Sears, a wealthy Boston patron of the arts, who liked the way young Skinner tuned and regulated an organ in his residence, sent him abroad, in 1898, to learn what he could from foreign builders.

There he met the Henry Willises, Senior and Junior, who permitted him to tape the measurements of reeds and of a fine tremolo, while the Junior Willis instructed him in the fundamentals of reed voicing, which so far as Skinner was aware, were unknown in America at that time. He was given the freedom of the great organ in St. George's Hall, went to Holland, Belgium, and France, where he visited organ factories, and upon his return, became superintendent of the Hutchings enterprise, and while at that shop made the acquaintance of William C. Hammond, of Holyoke, who headed the list of men of sterling character that aided Skinner in the formative period of the organ which bears the latter's name.

In 1901 Mr. Skinner, with capital of \$4,300, a part of which had been derived from royalties on a piano accenting device, known as the themodist, opened a modest organ factory in South Boston, and built the organs that were installed in the Evangelical Lutheran Church of New York City, and of Grace and Plymouth Churches in Brooklyn, and four years later a corporation was formed, known as the Ernest M. L. Skinner Company, with George Foster Peabody of New York, making the first subscription to the stock, the remaining issue being taken by Worcester men.

With the new capital Mr. Skinner built the organs installed in the Cathedral of St. John the Divine, St. Thomas Church, Columbia Uni-

versity, and the College of the City of New York, all in New York City, in Trinity Cathedral, of Cleveland, Ohio, and some two hundred others.

The office force consisted of Mr. Skinner, a bookkeeper, a stenographer, and a draughtsman.

The founder of the business modestly said that what he had done in creating the Skinner organ was due almost wholly to his love of music, plus a mediocre inventive faculty and an unbounded belief in the possibilities of the instrument. Believing that the symphonic orchestral colors were as necessary to an organ as they are to an orchestra, he worked under the stimulus of great orchestral or operatic productions in producing all the orchestral colors that dominate the Skinner organ. Their reception by various organists has been curious and follows as definite a law as the schedule of probabilities in an insurance expectancy table. Those interested in music for the sake of the art itself have welcomed these voices in the organ, while the classicist, the ritualist and the purist have frowned upon them. But Mr. Skinner was adamant in his belief that they were an essential part of the organ, and he kept on producing them.

To attempt to catalogue the installations of the Skinner Organ Company would be to list the prominent churches, halls, theaters, colleges, schools, clubs, libraries, museums, auditoriums, institutions and residences in America, as well as of foreign countries.

In 1919 the Skinner Organ Company was incorporated and Arthur Hudson Marks assumed the office of president, having secured a controlling interest in the enterprise. He was formerly vice president and general manager of the B. F. Goodrich Company. Ernest M. Skinner became vice president, in charge of the technical and artistic fields, and William E. Zeuch, one of the leading organists of America and formerly in the sales department of the Aeolian Company, was also elected a vice president. George O. Kingsbury, formerly president of the Steere Organ Company, became secretary, and George L. Catlin, formerly assistant treasurer of the Locomobile Company, was elected treasurer and general manager.

The main factory, general office and studio are located at Dorchester, while another studio and a sales office are maintained at 677 Fifth Avenue, New York City. From 1921, when the company bought the plant of the Steere Organ Company in Westfield, up to 1929, this unit was operated as a branch, but in the latter year all production was concentrated at Dorchester. The company's sales increased in a five-year period 1.95 times and its profits advanced 5.38 times, in the same number of years, through increased efficiency and reduction in overhead.

The policy laid down by the founder at the beginning has been rigidly adhered to, and each succeeding product has been built of the best material, in the most workmanlike manner, and has taken its place alongside the others as a distinctly beautiful instrument which would command the admiration of organists.

While the success of the present management of the Skinner Organ Company is well known throughout the industry, it is not, as one might surmise, due simply to increased sales effort and greater volume of business. These are factors, it is true, but the improvement in the workmanship and tonal quality of the Skinner Organ are considered the primary reasons for the growth of the concern. The management has paid more

attention than ever before to the building and finishing of each organ and has continually added skilled craftsmen to the organization. This policy has resulted in enhancing the house name still higher in reputation and has enabled the company to command higher prices than are quoted by competitors. In fact many large and important contracts are awarded to the concern without any other builder being considered.

When the city of Cleveland installed a \$100,000 Skinner organ in the auditorium where the 1924 Republican convention was held, the choice was made by taking a poll of 118 of the best-known organists of the country, eighty-seven of whom voted for the Skinner instrument. The City of St. Paul, Minn., purchased a \$75,000 organ as a result of a similar vote.

In the radio field, the Skinner concern was a pioneer, broadcasting weekly recitals through WEAJ and later conducting similar programs through the A. T. & T. system in half a dozen Eastern cities, and from Boston through WNAC, with occasional air recitals from Cleveland and Pittsburgh. The company has capital of \$1,000,000 common stock and employs 250 operatives.

THE NATIONAL CAN COMPANY

In 1901 Hyman Stern established the National Can Company at 13 Minot Street, with capital of \$100, where 100 square feet of floor area were occupied. The following year the concern removed to 289 Commercial Street, where 2,000 square feet of floor space were utilized, and in 1904, when larger quarters were demanded by increasing business removal was made to 36 Washington Street, North, where the concern originally took over 5,000 square feet, which total was subsequently increased to 20,000 square feet.

In 1924 the company erected its own modern plant at 71 Locust Street in the Upham's Corner section of Boston, where 25,000 square feet of floor area are utilized in manufacturing, and where the concern owns land area of 100,000 more square feet.

In 1913 the founder's son, David, became a member of the firm, and seven years later a second son, Harold S., became a partner.

When Hyman Stern began business he had but one employee, but today the partners utilize the services of fifty men in producing tin cans for commercial purposes, and ash cans for the general trade.

In 1901 the Roxbury Shoe Thread Company was established and was incorporated five years later. The plant is equipped with 1,140 twist spindles, and employs eighty operatives in the manufacture of shoe, suit case, bag and sail threads. W. H. Gould is treasurer, and B. G. Hodges, vice president.

THE PERIN-WALSH COMPANY

In a small shop located near the plant of the Perin-Walsh Company, the late John J. Walsh started a business for the construction and repair of wagons, in 1902, under the name of J. J. Walsh & Co., and prospered from the start.

Upon his death, in 1915, his three stepsons, Martin F., Edward J., and Roger A. Deveney, assumed control and management of the business. Martin F. became treasurer and general manager; Edward J., sales manager, and Roger A., plant superintendent.

Foreseeing the rapid development in motor truck transportation they began to manufacture custom-built motor truck bodies in addition to their other work, and soon earned for themselves an enviable reputation in this field.

Five years later the business had grown to such proportions that the J. J. Walsh Company was incorporated on July 1, 1920.

In 1924 there came another consolidation, at which time the Perin-Roloff Company was acquired by purchase. This concern had started to manufacture the now famous Roloff demountable bodies. Following this consolidation, the corporate name was changed to Perin-Walsh Company, and the Roloff bodies were developed by the new organization to their present high state of efficiency. In addition to Roloff, the company soon developed the Freightainer bodies for shipping package freight. Both of these units have been tremendously popular, due to the time and money-saving possibilities they afford.

The company has recently been appointed distributors of St. Paul hydraulic hoists, Mead-Morrison Winches, R. & S. cabs, as well as a complete line of Arcadia stock bodies.

The plant at 1540 Columbus Avenue, Roxbury, is made up of a group of buildings, containing over 75,000 square feet of floor space, and 150 men are employed. The corporation has capital of \$1,000,000. Donald W. Perin is president; James M. Graham, secretary, and Martin F. Deveney, treasurer.

FAIRCLOUGH & GOLD, INC.

The firm of Boutwell, Fairclough & Gold was organized in 1902, and upon the retirement of the senior partner some years ago the concern was incorporated as Fairclough & Gold, Inc. It is engaged in manufacturing and converting all kinds of curtain materials and decorated fabrics, and is the sole producer of the famous Bedford scrim, which has held a unique position in the curtain field for eighteen years.

The company's distribution is nationwide, and it exports a considerable percentage of its products to Australia, South America, and London, England, in all of which places it maintains offices, in addition to its sales headquarters in New York and Chicago.

William R. Fairclough is president; W. Z. Brandon, vice president, and Samuel Gold, secretary and treasurer. Upwards of 300 operatives are employed by the corporation, which has capital of \$400,000.

THE UNITED DRUG COMPANY—THE WORLD'S GREATEST INDUSTRY OF ITS KIND

In September, 1902, at the annual convention of Vinol Agents, held at the Hotel Brunswick, Boston, the United Drug Company was born, with E. D. Cahoon, of the William B. Riker & Sons Company, of New York, as president; E. L. Scholtz, of the Scholtz Drug Company, of Denver, Colo., as first vice president; James L. De Merville, of the De Merville Drug Company, of Nashville, Tenn., as second vice president; James K. Wetherald, president of the Chester Kent Company, of Boston, as treasurer, and Louis K. Liggett, of Boston, as secretary and general manager.

This corporation, which in a quarter of a century has become the largest enterprise of its kind in the world, resulted from an idea born

on a railroad train between Seattle and Spokane, Wash., evolved from the mind of a twenty-five-year-old American traveling salesman, himself a native of Detroit, Mich.

When the concept flashed through the brain of Louis K. Liggett that the path to success in the drug industry of the United States lay in pooling the business of individual drug stores he had no idea of the pace at which his vision would travel or the sphere of influence it would cover in less than a quarter of a century thereafter.

Calling on forty druggists in as many cities of the far and middle west, young Liggett imparted his plan of something different than these men had ever thought of before, and, securing \$4,000 from each of them, the corporation came into being for the purpose of making and distributing the goods to be sold to the public in these two score stores; of ultimately merging into national distribution thousands of local and divergent medicinal and other specialties; of establishing economies in production and distribution, and of consolidating these influences into one composite whole.

These original investors, who became manufacturers and distributors, were not only able to make larger profits, but it was given to them to supply the public with better goods in larger quantities and at lesser prices than previously.

Thus was the Liggett idea to become long before the end of the first quarter of the twentieth century by far the largest drug industry in all the world, with more than 1,300 stores in the United States and Great Britain, and upwards of 10,000 stockholder-agents in both countries.

But there was the germ of a bigger idea involved in the set-up of the United Drug Company than the mere economical production and distribution of drugs. The component units talked the same language, unfolded to each other all the secrets of their respective stores and dispensed inspiration to do a better and bigger business, while the progressives stirred up the conservatives, and the practical merchandisers in the constantly growing group exchanged ideas with those who lived in the purely ethical world, and there were thus established binding friendships—all of which developed into service to the communities where they so successfully operate today.

THE FIRST YEAR'S BUSINESS

On January 1, 1903, the corporation began business with twelve employees, and on the fourteenth of the following March it shipped its first order, amounting to \$1,625.35.

The company's trade mark, "Rexall" was announced to the public by full-page newspaper advertisements, which carried the single letter "R" the first day, "Re" the second day, "Rex" the third day, and so on until the entire word appeared—probably the most novel and original publicity campaign ever conducted, and arousing widespread curiosity in every city and town in the land.

The first year's business, done in a part of a building containing 30,000 square feet of floor space, in Boston, amounted to \$67,000, but expansion quickly followed until today it requires an eight story concrete building covering an entire square in the City of Boston to produce simply the confectionery products supplied to the Liggett and Rexall stores of the United Drug Company, into which enter carloads of cocoa beans from

Venezuela, Mexico, Central America and the West Indies, nuts by the ton and fruits fresh from the vines and trees.

By May, 1903, the company had grown to 250 stockholder-agents, and 150 employees and on September 29-30, 1903, there was held at the Hotel Brunswick, Boston, the first annual convention, with 172 stockholders, out of 338, in attendance, and in a half-hour \$65,000 worth of Rexall-Mucu-Tone was sold at auction, with total sales that day, amounting to \$75,000. During the months of October and November, of that year, the company shipped more of its own goods than it had in the first six months of its existence, and in December the plant was oversold by more than 50% of its capacity production.

In February, 1904, the first single carload of products was sold to an Indianapolis dealer, and by April of that year the company had grown to 600 stockholders. In September, the first addition to the original Boston plant was completed and on March 14, 1905, the second anniversary of the first billing of products, the sales totaled \$10,014.14, or six times the initial shipment.

On July 28, 1905, the first seven per cent dividend on the preferred stock was paid, and at the third annual convention, in Boston, in September, candy orders were received amounting to \$20,000 and the organization of the National Cigar Stands Company was approved.

On February 6, 1906, laboratory No. 2 was opened, affording 20,000 additional square feet of floor space, and twenty-two days later the Chicago branch was opened. In March, additional land was purchased in the rear of the original Boston plant, in order that a spur track might be installed. The following month a \$30,000 power plant was added and on May 15, 1906, the stockholders increased the capital stock from \$125,000 to \$375,000 to provide for new Rexall agencies, followed on November 15, of that year, by an increase of the preferred stock from \$375,000 to \$500,000, and of the common by the same figures, giving the company a total capital of \$1,000,000.

In December, of that year, the first perfume products made by the concern were ready for the market. The company contracts for the ingredients for these commodities in the floral fields of France and Bulgaria, distilling the concretes or essence of petals, and blending them into tantalizing odors through the medium of automatic machinery. When it was found in 1906 that the company had marketed \$127,000 worth of Saturday candy at twenty-nine cents per pound, this total was considered a vast sum, but when compared with the present Mother's Day sales of confectionery in one day, amounting to \$650,000, the total appears rather insignificant.

In March, 1907, the manufacturing and retail business of the Jaynes Drug Company of Boston was bought, the retail end being placed under the management of William B. Riker & Son Company, of New York, and the manufacturing end being consolidated with the United Drug Company's Boston plant.

By May, 1908, the company had doubled its stock issue and had tripled its business, and up to that time the original preferred stockholders had received 35% in dividends, while the same month—five years after business had commenced—a dividend of one per cent was paid on the common, this being repeated on July 29.

When the sixth annual convention rolled around, August 25-27, 1908,

with 634 stockholders in attendance, the company inaugurated a \$200,000 advertising campaign, which seemed a tremendous sum then, but quite insignificant when compared with the present-day \$1,500,000 annual campaigns for publicity.

In November, 1908, the United Druggists Mutual Fire Insurance Company was organized with original capital of \$100,000 and the following May an addition, two-thirds as large as the original manufacturing plant, was built, at Boston, financed entirely out of surplus, and designed to afford employment to over 1,000 persons, the land, buildings and equipment then having a value in excess of \$500,000.

THE COMPANY'S RAMIFICATIONS

Building up one of the largest toilet goods' businesses in the world on the policy of large volume sales, low manufacturing costs, reasonable profits, and quality value there has been scarcely a year when the company's production could care for its increasing sales.

In September, 1909, the Louis K. Liggett Company was organized to combat the competition of a chain of retail drug stores, and thus protect the Rexallites and to maintain the exclusive agency plan of the United Drug Company.

A contract was awarded in December, 1910 for a new eight-story candy factory, containing 100,000 square feet of floor space, and to employ 600, in Boston, and the following May a warehouse was leased in St. Louis, and an addition was started to the original Boston plant to provide room for the stationery department, the sales of which unit in seventeen succeeding years totaled \$32,000,000.

In 1911 an office was opened in Paris and that year the common stock was placed on an 8% dividend basis.

It was in July, 1912, that the company leased property at Broadway and 34th Street, in New York City, at an annual rental of \$110,000, and the management was severely criticized, but from the day the store opened on October 5, 1912, to the present, it has been the third most profitable unit in the Liggett chain. In March, 1913, the second retail store in New York City was opened in the Grand Central station. The same month, when floods, tornadoes and cyclones caused devastation in Ohio, Indiana, West Virginia and the Central States, an appeal was made to all stockholders to aid Rexallites in the stricken area, with the result that there was then created the Rexall Relief Fund, which still continues. On April 1, 1915, the first one-cent sale was offered to Rexallites—a plan that has done more to develop merchandising than any other inaugurated by the company, and one that has been widely copied.

In September, of that year, all of the stores owned by the Riker Company of New York, doing a business of between fifteen and sixteen millions were bought, adding 110 retail units to the United chain.

On April 12, 1917, the first 5% common dividend of the reorganized United Drug Company was declared and that month, when this country entered the World War, the corporation subscribed to \$400,000 worth of Liberty bonds, and appealed to its stockholders to buy until it hurt. In July, 1917, the Seamless Rubber Company, of New Haven, Conn., was purchased, and produces the rubber products handled by the stores.

On January 10, 1918, the United States Government accepted the proffered services of the United Drug Company and its 7,000 Rexall stores

became the recruiting stations for the merchant marine, with the result that in May of that year, the director of recruiting announced that more applications had been received from this agency than were required. In forty-five days, 84,000 marines were enrolled through the Rexall Stores, with no expense to the government.

Then came the purchase of Boots Pure Drug Company, Ltd., of England in June, 1920, then owning and operating 627 drug stores in England and Scotland, and four manufacturing plants, and doing a business of \$32,500,000 annually, followed by the formation of Liggett's International Ltd., Inc., as a holding company for the business in Great Britain and Canada. That this purchase was advantageous is attested by the fact that in 1927 the Boots' retail business amounted to \$47,000,000, plus more than \$50,000,000 wholesale.

In 1920 came the formal opening of the St. Louis plant. The next year the authorized common stock of the United Drug Company was increased from \$35,000,000 to \$55,000,000, the increased stock to be held in reserve for conversion purposes, and at the same time an issue of \$15,000,000 eight per cent twenty-year gold bonds, convertible into common stock at \$110 per share, was authorized to finance the company's floating indebtedness, which was then in excess of \$18,000,000.

On July 27, of that year, came the transfer of President Liggett's personal assets to three trustees, which was immediately followed by an avalanche of letters expressing faith in him, the crash of United Drug Company's securities in the market, the passing of the common dividend as well as the common dividend of Liggett's International.

On November 28, of that year, four months and a day after Mr. Liggett had transmitted his explanatory letter to the stockholders of the several companies he was interested in, the three trustees were discharged, and the Rexall Loyalty Trust Fund was formed by the voluntary action of the Rexall druggists—one of the most outstanding demonstrations of a group of business associates in the annals of American finance.

The first of the following August found the United Drug Company with a reduction of \$4,570,000 in liabilities, with \$820,000 worth of bonds retired, with its accounts payable reduced by \$300,000 and in the best financial condition it had been since the expansion period began in 1919.

On May 29, 1923, a one and a half per cent dividend was declared on the common stock, and the United Drug Company had no bank indebtedness, although two years before that time the enterprise had owed \$22,500,000, due to the expansion policy, which cost twice the amount of the original estimates, and to large inventories of raw materials purchased at high prices.

In October, 1924, arrangements were made to pay off the first of the following month the Rexall Loyalty Fund certificates in full, with interest added to that date, and on February 15, 1926, the United Drug Company became the direct owner of all the outstanding common and preferred stock of Liggett's International.

TWENTY-FIVE YEARS OF PROGRESS

Upon the occasion of the company's silver jubilee convention in 1928, President Liggett was able to report that while in the first working year of the concern—a period of only ten months of the full calendar year, the

gross sales were \$65,000, those of the fiscal year of 1928, including the Canadian and English companies, exceeded \$160,000,000.

He was also able to emphasize the fact that the United Drug Company, of Canada, had paid a dividend to the parent company, on July 1, 1928, something that had not occurred since 1921, and that while in 1925 the United Drug Company had owned 750,000 shares of stock in the Boots Pure Drug Company, Ltd., which was selling at that period at seven pounds per share, it had been possible in the intervening three years up to 1928 to declare a fifty per cent stock dividend, thus increasing the issue to 1,125,000 shares, and that at the time of the 1928 silver jubilee that stock was selling on the market at seven pounds per share, and had paid regular dividends in the interim.

It was also during the years from 1925 to 1928 that not only Liggett's International, but all the Boots stock and that of the Canadian Company was acquired by the United Drug Company, thus doing away with all the subsidiaries.

In 1928 came the consolidation of the Sterling Products Company by the United Drug Company and the formation of a holding company, known as Drug, Inc., a development which in no way affected the United Drug Company as that corporation still operates and will continue to function in accordance with its original fundamental principles. The only difference is that investors who desire to acquire an interest in the United Drug Company must purchase stock in Drug, Inc., the holding company.

There was no alteration in the contracts, principles or methods of either the United Drug Company or the Sterling Products Company, but in merging the stocks of the two corporations, the officers accomplished exactly what an intelligent insurance executive does when he "spreads the risk."

The enlarged company carried out an aggressive expansion policy in 1928, increasing individual stores from 460 to 506, and taking over on January 2, 1928, the May Drug Stores, in greater Pittsburg, doing an annual business of \$4,000,000, as well as Life Savers, Inc., which had an annual income of \$1,200,000, the Wolff-Wilson Drug Company, of St. Louis, operating eight stores, whose total business was \$2,500,000 annually, one unit having a sales volume of \$1,000,000 a year, a figure equalled by but few stores in this country.

In Chicago, three chains with twenty-seven stores were acquired in 1928, and early in 1929, Drug, Inc., was operating 535 stores in this country.

When the merger was effected with Sterling Products, a new concern known as Drug Products, Inc., was created, through which the former unit, United Drug Company, engaged in the manufacture and distribution of drug store merchandise and accessories, added the nationally advertised products which Sterling Products had previously manufactured and marketed through its strong and intimate connections and agreements in Continental Europe and South America, as well as throughout the United States.

Thus were brought together the vast ramifications of these two leading units in the drug and medicinal fields, including the chain of 500 Liggett drug stores located in the principal cities of the United States, and with thirty-eight stores in Canada, as well as the large manufacturing business

and the more than 800 retail stores of Boots Pure Drug Company, Ltd., of Great Britain, in which United Drug owned the controlling interest.

The new united enterprise has effected substantial economies in manufacture, in purchases of raw materials and supplies, and in advertising, while the diversification of the sources of income of the new company has proved to be a factor that has substantially added to the value of its securities. The merger in no way affected the Rexall dealers except possibly to add to the exclusive privileges they heretofore enjoyed and which are now increased as the result of this enlarged relationship.

Three large stationery factories in Worcester and elsewhere produce envelopes and letter-paper for the United Drug Company; a plant at Highland Park, N. Y., turns the grapes produced on the soil of the Empire State and the strawberries grown on the company's Virginia farm into fruit juices, while tobacco companies and other producing groups contribute to the varied needs of the corporation.

In 1925 when the United Drug Company cancelled its contract with the Owl Drug Company and decided to establish its own stores on the Pacific Coast, there were 302 Liggett stores in the United States. On June 30, 1928, there were 463 such stores, one new store having been added each week on the average during the three years period.

Of the original forty stockholders who formulated the fundamental principles of the United Drug Company, but thirteen of the total were New Englanders, and of that number nine were carrying on business in Massachusetts cities, two were in Connecticut, and one was in Rhode Island. The remaining twenty-seven represented fifteen other states, thus giving eighteen out of the forty-eight states in the Union representation in the corporation. The other states were New York, with seven, Ohio, with five, Missouri and Michigan, with two each, and Illinois, Wisconsin, Colorado, Tennessee, Minnesota, Pennsylvania, New Jersey, Kentucky, Indiana, Nebraska, and Utah with one each.

THE GREATEST ENTERPRISE OF ITS KIND IN THE WORLD

The United Drug Company has had an almost miraculous development from humble beginnings, until it has become the greatest corporation of its kind in all history.

Financially, it is impregnable; in its influence, it is world-wide; and as a composite entity the individuals who comprise it are integral parts of a mosaic of which every unit is essential to its perfection. The singular thing about the man who is privileged to display the symbol of Rexallism is that he is enabled to do so with the proud assurance that his welfare and his individuality count for as much today as did the welfare and individuality of the original forty stockholders.

The cynic is completely answered if he dares cavil at this statement, because all that it is necessary to recall is the magnificent response that the Rexall druggists have demonstrated in extending practical sympathy whenever disaster has menaced the prosperity, or perpetuity of their fellow-members.

The United Drug Company is a living example of the transmutation of the Brotherhood of Man from a lofty ideal to an enduring actuality, through the application of its fundamental principles to modern business.

The record of the company shows it is not a mere corporate entity,

and a creature of charters, by-laws and involved financial reports, but a human and humanizing institution in which dollars have been the means, but not the end, of achievement.

Perhaps the most significant fact in connection with the inception, growth and progress of the United Drug Company is that in creating this great industry, Louis K. Liggett, its founder and controlling head, at the time of its formation a traveling salesman whose territory embraced the domains of the nation from the Middle West to the Pacific Coast should have found it desirable, if Massachusetts and New England were on the verge of industrial decadency, to locate the United Drug Company in Boston, as he did. The fact that he chose to establish its main headquarters in the capital city of the Commonwealth, rather than in one of the great industrial marts of the Middle West, is merely added evidence that Boston and Massachusetts are still favorably regarded as desirable places in which to locate the great industrial enterprises of modern times.

The company's officers are: president, Louis K. Liggett; first vice president, George M. Gales; vice presidents, H. L. Simpson, E. J. Griffing, F. N. De Rosset, W. C. Watt, J. R. Sammons, H. E. Price, Arthur H. Stout, and Charles McCallum; treasurer, J. A. Galvin; secretary, Brenton K. Fisk.

Altogether the corporation employs upwards of 25,000 workers, and is capitalized for \$50,000,000.

Twenty-eight years ago Louis K. Liggett could scarcely have dreamed what heights would be attained by the corporation he conceived in less than three decades.

From total sales of \$62,000, in 1903, the first full year of business to more than \$150,000,000 in 1928, exclusive of those of Sterling Products, Inc.; from forty stockholder agents at the outset to more than 10,000 today; from a distribution to the two-score stockholder agents to merchandizing directly through some 600 wholly-owned stores in this country and Canada, and controlling more than 800 through Boots Pure Drug Co., Ltd., of England; from a small factory to manufacturing activities which cover such widely separated fields as stationery, candy, food products, rubber goods, and every variety of medicinal products, has emerged this Lilliputian of 1903 to the Goliath of 1930.

The consolidated report of Drug, Inc., covering a period of eleven months ending December 31, 1928, showed gross profit of \$45,710,073, with net income available for dividends of \$12,014,335.

The manufacturing plants of Sterling Products, Inc., and the merchandizing organization of the United Drug Company constitute a well integrated company which, with the financial strength displayed in the consolidated balance sheet of December 31, 1928, showing current assets of \$44,862,845 compared to current liabilities of \$8,851,140, places the company in an enviable position in a field of business in which it is the outstanding factor.

Drug, Inc., is now the world's largest factor in the manufacture and distribution of drugs and allied products, and in 1929 it acquired the units of the Bristol-Myers Company, the Three-In-One Oil Company, and the Wolff-Wilson Drug Company. As a result of its expansion program it now has twelve manufacturing plants east of the Mississippi River, five in Canada, two in England and one each in Cuba and Australia, with 552 retail drug stores in this country, in addition to 1,000 Rexall agents,

thirty-eight in Canada, and 860 in England and Scotland. It is estimated that the company reaches twenty-five per cent of the population of the United States. The Bristol-Myers Company acquired last year sells its products in twenty-six foreign countries, thus adding to the important connections possessed in Continental Europe and South America by the United Drug Company and Sterling Products, Inc.

THE BOSTON INSULATED WIRE & CABLE COMPANY

In March, 1905, H. B. Burley, Henry A. Clark, Henry E. Rooney and George Curtis as the principal sponsors, incorporated the Clark Insulation Company, and following the death of Mr. Clark two years later, and the acquirement of Mr. Curtis' interest by Mr. Burley, the name of the concern was changed, in 1907, to the Boston Insulated Wire & Cable Company.

From 1905 to 1909, the enterprise occupied leased premises on Freeport Street, in the Dorchester district, but in the latter year erected a modern factory, at Savin Hill station, adjacent to the tracks of the New York, New Haven & Hartford Railroad Company, containing 55,000 square feet of manufacturing area.

Since 1907 the company has been under the management of Mr. Burley, with Mr. Rooney in charge of manufacturing operations.

The company's products comprise mainly rubber insulated wires used for general lighting and power purposes, various special cords and cables, telephone wire and starting, lighting and ignition wires for automobiles.

In 1911 a branch factory was established at Hamilton, Ontario, and in 1918 this was made a separate corporation under the name of the Boston Insulated Wire & Cable Company, Ltd. The products manufactured there are similar to those made at the Boston plant, and the sales of the Canadian unit are made throughout all parts of Canada. The sales from the Boston factory are largely centered in the central and eastern states. The business of both companies has been growing steadily.

The Boston corporation has capital of \$100,000 and employs 250 operatives. H. B. Burley is president and treasurer, and J. C. Burley, secretary.

AN INVENTION THAT HAS SAVED MILLIONS—THE GOW SYSTEM OF CAISSON FOUNDATIONS

Few if any contributions to the science of modern building construction have been more important or far reaching from the standpoints of efficiency, expedition and economy both of time and money, than the Gow System of Caisson foundations, which was originated, designed, patented and applied by Col. Charles R. Gow.

It is doubtful whether many buildings of great heights in a large number of the cities of this country could have been erected lacking this method of carrying the supporting columns of structure through underlying strata of unsuitable soils to firm bearing material capable of safely sustaining the super-imposed load of construction materials and building contents.

Wherever underground conditions permit the adoption of the Gow method of foundation construction there invariably results a marked sav-

ing of time and inconvenience as well as a substantial reduction in the cost of installation over any of the alternatives available.

The Gow system provides for a single cylindrical concrete shaft of sufficient cross-sectional area to carry the concentrated load of the building and is sunk through any unsuitable upper layers of soil to a satisfactory bearing material, upon which the load is distributed by an enlargement of the section in the form of a conical frustrum so designed as not to exceed the safe unit supporting capacity of the particular soil selected for the purpose.

This type of construction has largely supplanted the use of large clusters of piles with their necessary capping of concrete or the sinking of sheeted open pits to considerable depths and the consequent building therein of a formed concrete pier resting upon a spread footing of plain or reinforced concrete.

The particular feature of the Gow System which appeals to engineers and architects is its extreme simplicity.

To install the caissons no expensive or cumbersome apparatus is required, while any number of footings may be worked upon simultaneously. Pier locations inaccessible to pile drivers or derricks offer no obstacles to the use of this method.

Only a minimum volume of excavation is removed equal in form and amount to the required displacement of the concrete shaft and base to be installed therein so that the walls of the excavation serve as forms for the concrete when it is poured.

Ready access may be had at all stages of the work for the purpose of inspecting the various strata of soil encountered or for checking the dimensions of the work. Similarly the bearing soil may be examined for approval just as in the case of any open pit. The concrete is visible during all the stages of depositing the same and there need be no uncertainty as to its character or sufficiency.

The method used in constructing Gow Caissons consists essentially in sinking a series of short steel cylinders varying slightly in their several diameters so as to telescope through one another, the largest size being used as a starter and the others in turn inserted successively through those already in place. In this manner a circular form of opening of the desired cross sectional area is maintained and ample protection is afforded at all times to the workmen employed in the process of excavating and subsequently in the placing of the concrete.

When the cylindrical excavation has reached the desired depth and has encountered the bearing soil selected as the supporting medium, the bottom of the opening is enlarged in the form of a truncated cone, having a base of sufficient area upon which to impose the entire load carried by the particular column without danger of overloading the underlying soil.

When the bottom excavation has been completed to its proper dimensions and the bearing soil has been inspected and approved, concrete, of suitable materials and proportions is deposited in the opening thus prepared so as entirely to fill the same, the several steel cylinders being successively withdrawn as the concreting work progresses.

The final result is a cylindrical concrete column resting upon a suitable spread base all of sufficient dimensions to carry safely the superimposed loading and to transfer the same to a satisfactory stratum of sub-soil.

The steel cylinders employed in the process serve not only to retain

the soil in place during the period of excavation, but they also act as coffer-dams to exclude the ground water from the opening until the completion of the operation. When inflowing water is encountered in the underlying bearing stratum itself, it is handled by a special method which has been devised for this purpose and which prevents it from rising into the opening while the depositing of the fresh concrete is under way.

Because of the meagre amount of headroom required for the installation of these footings it is entirely practicable to work in very restricted places, such as the basements of existing buildings or under walls and footings of structures requiring strengthening or underpinning.

In many instances it is entirely possible to install footings of the Gow type on sites covered by water, a cylinder of sufficient length being employed as a starter so as to act as an ordinary coffer-dam with its lower end embedded in the underlying mud while its upper end extends above the water level.

In situations requiring the building of footings close to property lines the Gow Caisson method is frequently found to be of especial value. Whereas the centre of pile clusters is bound to be at a substantial distance from the line, thus necessitating expensive cantilever construction for the carrying of the outside columns, the caisson type permits a minimum of eccentricity of loading because the shaft may be sunk directly against the property line while any eccentricity induced by reason of the base being off centre may be compensated for by reinforcing bars properly placed to prevent bending in the vertical shaft.

Another distinct advantage possessed by this type of foundation lies in the minimum depth of construction required. Wherever ordinary piles are employed for such purposes it is necessary to drive them not only to a good supporting stratum but also into the same for a distance of several feet in order to secure adequate resistance, whereas, by the Gow method it is only necessary to carry caissons to the top surface of the bearing stratum. This consideration is frequently of great importance when the supporting stratum grows softer at increasing depths, a condition which is not at all uncommon. In all such cases the hard top crust of the material acts as a distributing blanket to spread the load over a much greater area of the underlying softer soil.

It has frequently been found advantageous to employ Gow Caissons when for purposes of progress it was desirable to proceed with the foundation construction in advance of the general excavation. Under these circumstances the cylinders are sunk from the original ground surface while the concrete is stopped at the upper sub-grade elevation. The additional depth of excavation required in such cases is comparatively inexpensive and where time is an important factor may be easily justified.

It is obvious that the method just described is applicable only when the soil at or immediately above the bearing stratum is of such a nature as to permit undercutting the excavation in order to form the conically shaped bell which distributes the load upon the supporting medium. This consideration requires that it shall possess a certain degree of cohesiveness as in the case of clay, silt, peat or cemented sand or gravel, but in the event that a material possessing suitable characteristics for bellling purposes is not encountered at the desired depth an alternate method has been provided to meet such a situation.

This alternate method provides for the utilization of a pre-cast bell

or footing, which is formed and concreted in a pit of shallow depth just below the ground level. This pre-cast bell is constructed with vertical sides which act as guides during the subsequent operation of sinking the same to its final position. It is built with a hollow interior in which workmen may be employed for the purpose of removing the excavation thus allowing the bell to settle as the removal of soil progresses until the selected bearing stratum is reached. As the sinking process proceeds, vertical steel cylinders are attached to the top of the pre-cast bells and are drawn down as the latter settles. Meanwhile a portion of the excavated material is used to backfill the annular space outside of the cylinder thus preventing any tendency for displacement of the surrounding soil.

When the pre-cast bell has been sunk to a satisfactory bearing material it is only necessary to concrete the interior of the working chamber and to fill and withdraw the steel cylinders in the usual manner in order to obtain the desired result.

In cases where a large shaft is called for by reason of the great load to be carried a pre-cast hollow concrete cylinder may be substituted for the temporary steel cylinder and made ultimately an integral part of the completed structure.

Prior to Colonel Gow's invention untold millions of dollars were lost or wasted because of ignorance respecting the probable behavior of various subsoils which were relied upon to support heavy loadings only to find that they were inadequate. Expensive buildings were destroyed or so seriously damaged by sinking walls as to necessitate costly repairs merely because competent and intelligent inquiry had not been instituted to ascertain the value of the supporting medium.

The Gow Company, Inc., successors to the original Chas. R. Gow Company, has been engaged in making analyses for the purpose of determining sub-surface conditions for more than twenty-five years past, and the work has involved the drilling of more than 200,000 linear feet of test borings in upwards of two thousand cases without a single criticism ever having been received of the results submitted. Col. Charles R. Gow, president of the company, has long been recognized as one of the leading authorities in America upon foundation and sub-surface problems and for many years he was engaged to give the course in foundations at the Massachusetts Institute of Technology. He has devoted his personal attention to the development of this department of the company's business with the result that its reports of underground investigation are universally accepted as authoritative in all quarters where the name is known.

He has been retained as consulting foundation engineer on a number of the most notable engineering contracts executed in this and other countries and is frequently called upon to make annual and other examinations of the foundations of internationally known structures such as bridges over extensive water courses and important public and private buildings.

The Gow Caisson Pile method is recommended by the leading architectural firms of America and employed by most of the great contracting and engineering concerns engaged in construction of large and costly buildings.

The Gow Company, Inc., has its principal offices in Boston and New York and employs 300 operatives.

Col. Charles R. Gow is president, Linton Hart, vice president, P. D. Case, secretary, and H. R. Moyer, treasurer.

THE MALDEN LEATHER GOODS COMPANY

The Malden Leather Goods Company, incorporated in 1913, with capital of \$15,000, was founded in 1905, succeeding the partnership conducted by Richard A. Thomas and Elliott W. Aldrich, under the same name.

From its inception it has been engaged in the manufacture of leather goods exclusively for advertising distribution.

The plant was originally located in Malden, but in 1919 it was removed to its present location at 116 Portland Street, where upwards of 8,000 square feet of floor space are occupied, and where it employs between forty and sixty persons, according to seasonal requirements.

It manufactures over 300 numbers, including memo books, card and pass cases, billfolds, desk clocks, and other desk specialties, including calendars and memo pads, vanity cases and special leather cases of almost every description.

Its distribution is nation wide, through established advertising agents. President R. A. Thomas who founded the company has spent over forty years in the leather goods industry, having entered it as a boy. The treasurer, Brent B. Lowe, has been connected with the company since 1914.

While the business is exceptionally heavy during the holiday season, and from September to January, it is fairly steady throughout the year, due to the established custom of distributing good-will merchandise, provided by the company. Fifty hands are employed and the company's Boston office is at 51 Chardon Street.

THE MEAD-MORRISON MANUFACTURING COMPANY

Nearly forty years ago a partnership was formed in Cambridge for the manufacture of hoisting machinery and fertilizer dryers, in which John G. Morrison was the directing genius, and at about the same period the Automatic Coal Handling Company was established in Boston, at the head of which was John A. Mead.

In 1904 it seemed expedient from the production standpoint to merge these two units, and the Mead-Morrison Manufacturing Company was formed, which today has capital of \$1,000,000, employs upwards of 500 operatives, and produces coal and ore handling and hoisting machinery, Frank P. Carpenter being president, W. S. Martin, treasurer, and Burton L. Gale, secretary.

Since the merger the company has manufactured most of the machinery used in the handling of coal by the United States Government and for many of the large railroad systems, while during the World War the concern supplied much of the machinery that made possible the landing of enormous quantities of supplies for the American army in France.

C. D. PARKER & CO., INC., AND THE MASSACHUSETTS UTILITIES ASSOCIATES

The story of the Massachusetts Utilities Associates illustrates the constructive efforts of a Boston banking house over a long period of years.

About 1905, the small firm of Jose Parker & Co., which had been dealing in small blocks of municipal and underlying railroad bonds for seven or eight years, successfully underwrote an entire issue of first mortgage bonds of the Orange Electric Company amounting to \$40,000. This was followed by another first mortgage issue of the Greenfield Elec-

tric Light & Power Company which was not so great a success for a period, due to the fact that the dam on the Deerfield River gave way and Jose Parker & Co., was forced to come to the help of the company until it pulled through its troubles. But these issues revealed a future for "public utilities," then classified as "industrials."

In 1907 came the financial panic and the firm of Gavett & Porter, which had been endeavoring to place an issue of Massachusetts Lighting Company's shares, sold the securities to Jose Parker & Co.

The Massachusetts Lighting Companies, a Massachusetts voluntary association, had been formed in 1901, by Arthur E. Childs and others. Mr. Childs, a graduate of McGill University, who as a young engineer had been assistant to Coleman Sellors, in the first electrical development at Niagara Falls, had grouped the Arlington Gas Light Company, the Spencer Gas Company, the Leominster Electric Light & Power Company, the Clinton Gas Light Company, the Milford Electric Light & Power Company and a few other small properties until by 1907 the Massachusetts Lighting Companies possessed a capital of \$600,000 represented by a single class of common shares, then selling at a slight discount from their \$100 par value. Gradually they were able to pay dividends of six per cent and the shares advanced in a few years to around \$115.

About that time Wallace G. Webber, against the advice of friends, purchased the decrepit Marlboro Electric Company, and by dint of developing a power load, something almost unheard of at that time, for a small electric light company, marketed an issue of 6% common stock, which sold in a short time up to \$150 a share.

In 1910, Mr. Webber purchased the Athol Gas & Electric Company and the Orange Electric Company, consolidated them, built a new dam on the Millers River, at Erving, and on his record with the Marlboro Electric Company, C. D. Parker & Co., which had succeeded Jose Parker & Co., placed the Athol Gas & Electric Company 8% stock with investors at nearly \$200 per share.

Acquiring the Marlboro-Hudson Gas Company the following year and with the corporation but partly rehabilitated, came the sudden death of Mr. Webber, which was a severe blow to the firm. The solution was the formation of a new voluntary association, known as the Commonwealth Gas & Electric Company which enabled Mr. Webber's two sons to carry on, and the estate was not forced to sell its valuable holdings until some of the benefits flowing from Wallace G. Webber's plans had been put into execution.

Then came a dismaying court decision, based on the fact that a Trustee in Massachusetts had placed too large a part of his trust funds in the Massachusetts Electric Companies, a street railway holding company, and the public at once jumped to the conclusion that all voluntary associations, or "trusts," were wicked. C. D. Parker & Co., not only was forced to struggle against the fact that the companies in which they were interested were small, but also because they were "trusts." A thorough investigation conducted by a Legislative committee, sitting with other governmental appointees, finally gave this particular form of organization a clean bill of health.

About 1910 C. D. Parker & Co., bought the Weymouth Light & Power Company which had been a private unincorporated venture, owned by the

Bradley family. The gross earnings of the enterprise were about \$50,000 a year.

The plant was gradually depreciated on the books of the concern and a favorable contract for the purchase of electricity was made with the Edison Electric Ill. Company of Boston. After the business had been built up for two years and had been placed on a paying basis, the stock was offered to investors at \$180 a share, as an 8% stock, and by 1928 the gross earnings had passed the \$500,000 mark.

Until about 1912, most investors in general favored railroad issues; many argued that an electric light company was unsafe, from the investment standpoint, because in case of trouble its plant would be regarded as mere junk and that it did not own a right of way as in the case of a railroad. Many thought electricity would soon make gas a commodity of the past, and that probably wireless inventions would edge telephone lines out of business.

Gaining experience in the building up of the business of small gas and electric light companies, C. D. Parker & Co., acquired successively: The Central, Massachusetts, Ware, Foxboro, Amesbury, Stockbridge, Lenox, Great Barrington, Winchendon and Plymouth Electric Companies, The Norwood, Gardner and Marion Gas Companies, Worcester Suburban Electric Company, and The Randolph & Holbrook Electric Company.

The Central Massachusetts Electric Company had been owned indirectly by the N. Y. N. H. & H. R. R. and its product was used mainly for street railway power. The story goes that if a resident of Palmer asked to have his house wired for electricity, the local manager climbed out of the back window to avoid talking with him. Today, the Central Massachusetts Electric Company, has over 8,500 customers and a motor load of upwards of 8,500 horse-power.

The Marion Gas Company owned a small acetylene gas plant and its little electric light plant served chiefly to illuminate the estate of Harry Converse, in the town of Marion. By junking the two plants, buying electricity from New Bedford and selling at wholesale to the Plymouth Electric Company and to the electric company south of the Cape Cod Canal and by securing a power contract with the big Marconi Radio sending station, at Marion, the company soon grew in size and changed its name to the Southeastern Massachusetts Power & Electric Company.

The common stocks of these companies when built up to a dividend basis, were sold to investors by C. D. Parker & Co., but not without much missionary work.

In 1913, the Massachusetts Lighting Companies split each of their capital shares, then paying 7%, into one share of 6% preferred and one share of no par common, paying \$1 per year, in order to accommodate the Trustee investor who desired only safety and the business man who trusted the future. The Massachusetts Lighting Companies was now a \$7,000,000 property and C. D. Parker & Co., had placed practically all its shares, few other banking houses having done much save to trade out the shares and advise against the purchase of utilities in general.

In the belief that sooner or later investors would realize the strength of public utility companies with their steady increase in earnings, C. D. Parker & Co., felt warranted in going against the tide inasmuch as the earnings of the Massachusetts Lighting Companies were increasing.

Then came the World War and to finance new construction require-

ments of the companies C. D. Parker & Co., underwrote a \$1,000,000 debenture issue and a second for \$1,160,000. When interest rates, the cost of coal, etc., went up faster than it was possible to increase rates, many gas and electric company issues suffered marketwise, and at the time the Investment Bankers Association held their annual convention in Boston, in 1920, the Board of Governors represented thirty-three houses and of these only three would recommend public utility securities.

A midwestern banker informed the delegates in attendance that the public utilities needed vast amounts of money, that they were good risks and that banking houses in general ought to appreciate and recommend them. Shortly afterwards, public favor turned to them, and most banking houses have since considered public utilities as their choicest issues.

After about five years of steady growth it was apparent that the gas and electric light companies in Massachusetts were attracting the attention of interests outside the Commonwealth. To protect clients who had stood by these properties in the lean years from the temptation of realizing a short profit when their long patience deserved more, C. D. Parker & Co., formed first voting trusts, and in 1927 the Massachusetts Public Utilities Associates was formed and brought all of the separate gas and electric companies in Massachusetts into a single fifty-million-dollar property, serving a territory with over 600,000 people, including one-sixth of the cities and one-third of all the towns in Massachusetts.

Now that electricity and gas can be distributed over long distances and the spread of the business peak means so much more than formerly, it is likely that a further consolidation will take place, which will mean much to the shareholders. It is only natural that C. D. Parker & Co., takes pride in the fact that it has aided these companies to increased business, enabled them to reduce their rates consistently, and gave more reliable and better service, and provided it clients with a satisfactory income and a good profit as a reward for their backing these companies.

While during all these years, C. D. Parker & Co., has been known for its work in building up the Massachusetts Utilities Associates, it has also dealt in the municipal bonds of many Massachusetts cities and towns, financed industrial and real estate properties valued at over \$20,000,000, and since 1920 has become interested in the natural and artificial ice business. In the National Service Companies, formed in 1928, were merged what were 100 separate ice companies, serving the principal New England cities from Maine to the New York City line and C. D. Parker & Co., believes that in years to come this corporation will equal the record of the Massachusetts Utilities Associates.

In the spring of 1929 C. D. Parker & Co., formed the Seaboard Utilities Shares Corporation, a Massachusetts corporation of the investment trust type to deal in a diversified list of essential utilities east of the Mississippi River. This corporation now has assets of over \$17,000,000 and since June, 1929, has increased its number of shareholders from 285 to 16,000. A similar Massachusetts corporation has been formed by the same interests to deal in railroad issues.

Railroad Shares Corporation, with over \$1,000,000 paid in and over 8,000 shareholders and Utilities Hydro & Rail Shares Corporation have both been underwritten and distributed by C. D. Parker & Co., Inc., and allied bankers during 1929 to give their clients an interest in 131 leading utility and railroad corporations of the country at the low prices rul-

ing since October of that year. These companies have added to C. D. Parker & Co., Inc., connections with representative utility, hydro-electric and railroad executives and bankers.

The firm of C. D. Parker & Co., was incorporated in Massachusetts in 1912. Chauncey D. Parker, one of the original partners of Jose Parker & Co., in 1896 is president. Bowen Tufts, to whose untiring efforts and ability a very large part of the firm's success is due, is vice president and Edward L. Bennett, president of the National Service Companies, is treasurer. These three, together with Charles R. Adams, Merton E. Grush of Winchester, and Harold B. Lamont, of Lexington, constitute the board of directors.

C. D. Parker & Co., Inc., operates branch offices in Worcester, Springfield, and Pittsfield, in this state, and in New Haven, Conn., and employs a total personnel of about seventy-five persons. Of the twenty salesmen at least a third have been with the firm fifteen to twenty years or more. No history of the firm would be complete without mentioning the long-time service of Mrs. A. M. Stone, cashier, who has been with the firm almost since it started.

THE HOWARD DUSTLESS-DUSTER COMPANY

The Howard Dustless-Duster Company was organized as a Massachusetts corporation in 1906 by F. A. Howard, who became its president and treasurer for the purpose of placing on the market a sanitary dust collecting cloth which, records indicate, was the first instance of a chemically treated fabric of its kind being offered to the public that possessed the properties of picking up and holding the dust instead of distributing it as was formerly done with feather dusters or untreated cloths.

A national advertising campaign was undertaken and the product was introduced to department and house furnishing stores after having been tested and approved by *Good Housekeeping*.

Immediately following the introduction of the cloth, cotton yarn mops for floors, walls, ceilings, etc., similarly treated, were developed and have continued to be marketed up to the present.

In 1915 the business was acquired by Harold L. Bradley and Rupert B. Rogers, the former becoming treasurer and the latter president of the corporation, with F. A. Howard as vice president, the three constituting the board of directors. F. A. Howard retired as an active official in 1927 and the company has continued under the management of Messrs. Rogers and Bradley.

Since that period, it was expanded its line of products to include other types of cleaning cloths, such as window, automobile, wiping and dish cloths and many other household appliances.

The office and factory are located at 493 C Street, Boston, and the corporation has capital of \$81,400.

MARTINEAU & BURKE, INC.

In 1906, William R. Martineau and Frank L. Burke, with capital of \$13,500 began the manufacture and sale of leather, at 46 Lincoln Street, Boston, under the name of Martineau & Burke, Inc.

Today, less than a quarter of a century after the inception of the enterprise, it has capital of \$1,198,094, and employs upwards of 500 operatives in its factories at Ipswich and Campello, in this state, and in

Chicago, Ill., and Leicester, England, where upwards of 350,000 square feet of floor space are utilized in the manufacture of outersoles and inner-soles, sheet heeling, sheet innersoling, sock linings, wax splits, leather and wood heels, and leatherboard.

The concern also carries on a jobbing business in sole and rough leathers, splits, bends, backs, shoulders, heads, bellies, heel stock, belt and welt, and leather offal.

The Boston headquarters at 44-46 Lincoln Street consist of a magnificent seven story structure, one of the best in the local leather district, and the corporation is another conspicuous example of the growth of a twentieth-century Massachusetts enterprise.

William R. Martineau is president and treasurer, and Campbell Bosson is secretary. The board of directors includes William R., and S. A. Martineau, Frank L. and Frank M. Burke, W. A. Keeler and W. T. Austin.

In 1906, Marshall Jones, formerly New England manager of Dodd, Mead & Company founded the publishing house of Marshall Jones Company, now located at 212 Summer Street.

RUST CRAFT PUBLISHERS, INC.

Twenty-five years ago the enterprise now internationally known as Rust Craft Publishers, Inc., which employs upwards of 300 operatives, did not exist, and it, like many another manufacturing corporation, migrated to Boston, from the golden west.

In 1906, in a little upstairs room of a Kansas City commercial building, Fred Rust opened a book shop, where he carried all sorts of unusual commodities, and where, in the fall of that year, he printed a plain Christmas folder, which he termed a "letter," but entirely without design or embellishment, save for a red capital letter.

It proved a successful seller during the holiday season, many customers buying in dozen and hundred lots, with the result that within two years, Mr. Rust had increased his private publications to thirty or more subjects. They were not only in the form of letters, but included post and greeting cards with envelopes, as well as calendars and blotters. A few for New Year's and for birthday anniversaries were added and found to be popular.

In the meantime, Mr. Rust's brother, Donald, joined the enterprise and assumed charge of manufacturing, and in 1908, Fred Rust carried the line to Boston, and Donald Rust went as far as the California coast. In 1910 the book shop and all retailing were discontinued, and four years later, after an extensive business had been built up, the firm removed to Boston, where it has since been known as Rust Craft Publishers, Inc.

Early in its career, the Messrs. Rust foresaw the approaching demand for cards for all occasions and for special purposes, and bon voyage, graduation, illness, Thanksgiving and other holidays, Easter, and special cards for all members of the family, were developed and sales mounted accordingly, until at present the corporation is doing a larger business in cards for every day use, in proportion to the Christmas holiday business, than any other concern of its kind in the United States.

Many artists of fame and writers of note are retained by the corporation in preparing the designs and sentiments.

Here is a corporation that came into Massachusetts less than fifteen years ago and that has built up a business utilizing capital of \$450,000, and maintaining display rooms, at 200 Fifth Avenue, New York City, and

at 56 E. Washington Street, Chicago, as well as a large plant, at 1000 Washington Street, Boston, and employing upwards of 300 workers.

Fred W. Rust is president, Donald E. Rust, treasurer, Oliver Wyman, secretary, and Ernest Dudley Chase is also associated with the group.

CHARLES T. MAIN, INC.

As an engineer in charge of construction projects pertaining to industry, and steam and water power developments, over a period of fifty years, Charles T. Main has come to be an international figure. From 1893 to 1907 he was a member of the firm of Dean & Main and from the latter year to 1926 Mr. Main carried on business in his own name, the present enterprise, Charles T. Main, Inc., being formed at that time. Some of the outstanding plants designed and constructed by Mr. Main are the Wood and Ayer Mills, in Lawrence, and in another field the Montana Power Company. He employs upwards of fifty engineers and assistants.

THE ANCHOR LINOTYPE PRINTING COMPANY

The Anchor Linotype Printing Company was incorporated in 1907, but its history really began January 1, 1859, when Curtis Guild issued the first number of *The Commercial Bulletin*, from his office at 129 Washington Street. Soon after the paper was established Benjamin F. Guild, brother of the founder, was admitted to partnership, and Curtis Guild, Jr., became a partner in 1883. In 1907 Curtis Guild, Jr., was sole owner of the business, as his father had retired six years before, and his uncle had died in 1902. As Governor of Massachusetts Curtis Guild, Jr., found almost no time to give to his personal business, and he invited his younger brother, Courtenay, to become his partner in 1907. Governor Guild died in 1915, and since that time the firm has had but one owner. The business of Curtis Guild & Co., has therefore been owned exclusively by one family for over seventy years.

The offices of Curtis Guild & Co., have been successively on Washington, Kilby, and India streets, and at 144 High Street, where the business is now carried on.

In 1859, and for about forty years later, the setting of type was done by hand. With the introduction of linotype machines into the composing room of *The Commercial Bulletin* it soon became manifest that the machines could handle much more work than was required for the issue of a weekly newspaper, and efficiency demanded the formation of an organization to conduct a printing business.

The partnership of the Guild brothers dated from June 1, 1907, when they opened a new office at 41 India Street. The linotype machine was still something of a novelty at that time, and as the office was near the water-front, "Anchor Linotype Printing Company" was the name chosen for the new corporation.

All the type and printing machinery of the newspaper were turned over to the new corporation which retains the *Bulletin* as one of its large customers. All shares of the corporation are owned by the Guild family, but the organization and business have always been kept independent of the newspaper, which has its office on the second floor, while the Anchor office is on the third floor of the Fort Hill Building.

During twenty-two years of independent operation the printing company has prospered and has gained a reputation for efficient service.

Newspapers, school and college newspapers, house organs, bankers' circulars, annual reports, catalogues, programs, and many forms of job printing are handled, and much political printing in city, state, and national elections is executed.

George W. McCoy, who has been manager for five years, formerly held a responsible position in the composing room of the *Boston Globe*.

The officers are Courtenay Guild, president and treasurer; S. L. Guild, clerk; and with George B. Dewson they form the board of directors.

MONKS & JOHNSON

The activities of the firm of Monks & Johnson, formed nearly twenty-three years ago, cover a broad field in architecture and engineering, but a specialty is made in designing industrial and commercial buildings, and in studying manufacturing processes and the handling and routing of materials.

The concern maintains a large staff of technically trained experts, whose service comprises preliminary reports and investigations, complete detailed plans and specifications, obtaining of competitive bids from contractors, supervision of construction, and the auditing of contractors' accounts.

Effective results have been obtained by combining architectural and engineering service in the design of office buildings, banks, department stores, clubs, and other structures.

During the war the firm was engaged by the United States Government for work which aggregated in cost over seventy-five million dollars, acting as the architects and engineers for large undertakings of the Bethlehem Shipbuilding Corporation at Fore River and Squantum, Massachusetts, Providence, R. I., Buffalo, N. Y., Sparrows Point, Md., and Alameda, Cal. The firm also designed munition plants for Colt's Patent Firearms Company, in Hartford, Conn., and for the New Britain Machine Company, as well as several other large corporations. In addition, the firm did the engineering work on several large buildings constructed at the Watertown Arsenal.

The two original partners were members of the class of 1903, of Harvard College, and studied engineering at the Lawrence Scientific School. After graduation, Mr. Monks was employed as an engineer in coal mines in West Virginia, and was later engaged in the design of coal handling equipment for several companies in New England. Mr. Johnson was retained as an engineer by a large power and light company in St. Louis and later became associated with an engineering organization in Boston.

Originally the firm specialized in the design of coal handling equipment and undertook a considerable amount of this work in the New England states and in New York City, and when reinforced concrete construction was in its earliest stage of development, pioneered in its design.

In 1926, Mr. Johnson, because of illness, was obliged to retire from the firm and the partnership at present consists of Messrs. A. G. Monks, H. D. A. Ganteaume, and E. W. McMullen.

The firm's activities have covered a large territory although much of its work has been undertaken in this vicinity. It has served the following representative Massachusetts concerns during the past twenty-three years: Bird & Son, Inc., the First National Stores, Inc., the Gillette

Safety Razor Company, H. P. Hood & Sons, Inc., the Jordan Marsh Company, the William Filene's Sons Company, the Dennison Manufacturing Company, the Forbes Lithograph Manufacturing Company, the Boston Fish Market Corporation, the Bay State Fishing Company, the William Underwood Company, the American Soda Fountain Company, the H. B. Smith Company, the Massachusetts Mohair Plush Company, the Western Electric Company, Decatur & Hopkins, the Waltham Watch Company, the Brockway Smith Corporation, the Chickering & Sons Piano Company, the Houghton, Mifflin Company, the General Sea Foods Corporation, Walter Baker & Co., Inc., the Walworth Manufacturing Company, the S. S. Pierce Company, the Mason & Hamlin Piano Company, and the Carter Rice & Co., Corporation.

KINNEY MANUFACTURING COMPANY

The basic principle involved in an improved type of rotary steam engine designed, invented and produced by J. Royal Kinney, the present chairman of the board of directors and the former president of the Kinney Manufacturing Company formed the nucleus of what has become in less than a quarter of a century the internationally known line of Kinney pumping equipment.

Starting out to manufacture one device and ending up by making another has been the experience of many inventors, and while poring over a pile of diagrams, Mr. Kinney, then engaged in putting the finishing touches to his design for a new type of rotary steam engine, discovered that by incorporating a few changes he could transform his invention into a highly efficient rotary pump.

While Mr. Kinney's rotary steam engine operated satisfactorily and economically it appeared on the industrial horizon during the early years of the present century and simultaneously with the advent of the steam turbine, as well as concurrent with improvements in other types of steam engines, and just at the period of the awakening of industry to the savings flowing from low steam consumption.

This latter factor became potent in Mr. Kinney's development of pumping equipment, and he at once proceeded to design and build new models, the tests of which proved so successful that capital was enlisted, and, in 1907, the Kinney Manufacturing Company was organized and began the manufacture and marketing of the apparatus.

The new pumps achieved instant success in many fields, due to their high operating efficiencies, and today are handling an extensive line of products, including innumerable types of oil, various kinds of syrups, and many different materials used by the paint and varnish, soap, textile and confectionery industries.

Several of the original ten pumps sold over twenty years ago are still in operation, and are rendering satisfactory service.

One of the recent Kinney installations was the fitting of pumps for handling gasoline on the new U. S. Navy airplane carrier *Lexington*, while the company has sold a number of its pumps to the Imperial Japanese Navy. Large industrial users include the Standard Oil Company, and the Ford Motor Company. Although the company manufactures pumps made from practically all metals which can be cast successfully, the bulk of its production is of an alloy iron type, this grade being used in

all working parts, such as the cylinder, piston, cams, liners, center pins and heads.

Production in the early days was confined to the S. D. Model, but recently another, known as the H. Q. Heliquad, has been developed for handling non-lubricant liquids. The latest development is a high vacuum pump capable of pulling to better than .002 of a millimeter of absolute vacuum. This pump met a real need and was quickly adopted by the cable industries for impregnation work, and by manufacturers of electric lamps, radio tubes and vacuum pans. A very dense, close-grained iron being essential for high-grade vacuum purposes, the use of nickel has made it possible for the Kinney concern to produce a suitable material.

The company's products were so well received that the original plant, on Medford Street found its facilities insufficient to care for orders, and removal was made to a three-story brick building, on Albany Street, where the concern operated until 1915 when a plant, containing four acres of floor space, in Jamaica Plain, was purchased, and the main office and manufacturing operations were established there. The concern now employs 150 men. The company's products consist of the Kinney plain and steam-jacketed line of pumping equipment and strainers, the Kinney road oiler and distributor used in the building and maintenance of highways, the Kinney line of friction clutches and cut off couplings, together with the latest development—the Kinney high vacuum pump, which has produced remarkable results, having pulled down to one micron and which is manufactured in sizes up to 800 cubic feet per minute capacity. The corporation has capital of \$2,000,000. E. B. Neal is president, Courtenay Guild, vice president and secretary, and Harold B. Neal, treasurer, with J. Royal Kinney, chairman of the board.

THE NEW ENGLAND FOUNDRY & MACHINERY COMPANY

In 1907 the Falls Clutch & Machinery Company of Massachusetts purchased of John Grant the foundry located at 133 Forest Street, Campello, the original capital of the corporation being \$20,000, which was increased to \$40,000, in 1920, and four years later, following extensive plant additions and the installation of new equipment, it was fixed at \$80,000.

In 1924, R. L. Ham succeeded V. R. MacBain as treasurer and at the present time the foundry executes very little work for the parent corporation—the Falls Clutch & Machinery Company, of Cuyahoga Falls, Ohio, but carries on a general jobbing foundry business having built up in the last half dozen years a number of excellent accounts requiring high-grade castings.

The Campello plant is now equipped with new machinery to meet present-day competition and production and no insignificant factor in its success has been the installation of an up-to-date cost production system evolved by Treasurer Ham.

Approximately sixty hands are employed. Theophilus King is president, L. E. Parks, secretary, and R. L. Ham, treasurer, and the latter's office is at 157 Federal Street, Boston.

THE GRIESS-PFLEGER TANNING COMPANY

The Griess-Pfleger Tanning Company was incorporated in 1907, being the outgrowth of the long-established firm of Griess, Pfleger & Co., of

Cincinnati, Ohio, which was founded in 1878, and which with its corporate successor has operated continuously for fifty-two years.

The Griess-Pfleger Tanning Company owns and operates tanneries in Chicago, and Waukegan, Illinois, and in Peabody, and a factory for the manufacture of insoles in Natick, with sales branches in Boston, Chicago, Cincinnati, New York, and Reading, Penn., and a foreign branch in Basel, Switzerland.

The Natick factory was started in 1920 to use the flexible splits made at the Waukegan tannery, and is the largest plant of its kind in the country devoted exclusively to the manufacture of insoles. Its production has averaged between fifteen and twenty million pairs of soles per year for the last six years, there being made at the plant over seventy different kinds, weights, and grades of insoles, all for women's McKay and welt shoes.

It employs from 100 to 150 people in practically ideal surroundings.

The Boston headquarters of the company are at 179-193 South Street. Edward Pfleger is president; Thomas S. Keirnan and Edwin T. Cady, vice presidents; and Ernest Griess, secretary and treasurer.

THE NORTHERN INDUSTRIAL CHEMICAL COMPANY

The Northern Industrial Chemical Company was founded in March, 1908, by G. Victor Sammet, Barthold E. Schlesinger and Greenleaf R. Tucker, the original plant being located at 68 Northampton Street, Roxbury. The concern started with a working capital of \$3,000 and one employee, and manufactured vegetable butter color, which was sold principally to the large Chicago packers for coloring oleomargarine.

In addition, a process for manufacturing a heat-resisting plastic was developed, which at the time found its chief use in the manufacture of coil housings for automobile ignition.

Both lines increased gradually and in 1916 the company moved to its present address at 11 Elkins Street, South Boston, occupying 12,000 square feet of floor space in a modern fireproof factory for the moulding department and a separate building for the butter coloring department.

In 1921 the U. S. Government permitted the use of aniline dyes for coloring oleomargarine, with which the vegetable color could not compete, and that plant was closed and discontinued.

The molding business was expanded by the introduction of Bakelite, which developed new fields for the use of plastics. In recent years there have been further enlargements, due to the discoveries of new plastics which have increased the application of the molding art, and at present the company occupies 36,000 square feet of floor space and employs 300 men and women. The invested capital represents approximately \$500,000. A large number of commodities are now manufactured for a great variety of industries.

The present officers are: G. Victor Sammet, president; B. E. Schlesinger, treasurer; and J. C. Fuller, and H. H. Wanders, vice presidents.

THE VOSE-SWAIN ENGRAVING COMPANY

When, in April 1908, Alfred E. Vose and Jasper R. Swain incorporated the Vose-Swain Company with capital of \$10,000, and established the concern at 119 Summer Street, the founders could scarcely foresee to what

heights the enterprise would rise in a little more than a quarter of a century.

Within two years the original headquarters proved inadequate and a removal was made to the Russia Building, at 530 Atlantic Avenue, where the fifteen original employees were increased to thirty-five.

In 1917 the capital was fixed at \$50,000, and additional space was acquired, while Ernest G. Persons and Edward L. Hornsey, who were in charge of important departments, acquired interests in the company. The concern now occupies two entire floors, containing 18,000 square feet of area, and 100 operatives are regularly employed.

A remarkable success has been achieved as the result of its singleness of purpose in adhering to the original idea upon which the enterprise was founded, namely, "quality stationery of the better kind, distinctively designed and engraved."

A quarter of a century ago, when the Vose-Swain Engraving Company hung out its shingle, people didn't think so much about putting on an attractive "front" in stationery as they do today. In other words, the value of quality in a letterhead which serves as a vehicle to carry a business message is being realized more and more, largely through the efforts of this and other pioneer concerns.

The Vose-Swain Company has won a wide reputation not only as a creator of original and distinctive stationery, personalized to reflect the character of a business concern for which it is designed, but also as a producer of personal stationery, business and personal calling cards, wedding invitations, Christmas greeting cards and announcements of all kinds. It has a thoroughly modern up-to-date plant, equipped to produce 150,000 engraved impressions per day.

Alfred E. Vose is president, and Jasper R. Swain, treasurer and secretary of the corporation, which has capital of \$50,000.

THE TIDE WATER OIL COMPANY

On June 2, 1908, the Tide Water Oil Company of Massachusetts, with capital of \$25,000 was organized to purchase and market petroleum products, the control of the corporation being lodged in the Tide Water Oil Company, of New Jersey, which holds a stock ownership of 100% in the Bay State unit. Based on the volume of sales since that year, the company's business has increased here 350 per cent,—figures which would seem to convey the impression to most people that Massachusetts and New England are geographical divisions that hold industrial and commercial possibilities for the investment of capital. E. L. Shea is president, M. N. Beebe, secretary and F. A. Marsellus, treasurer.

THE NEW ENGLAND FISH EXCHANGE

In 1908, the New England Fish Exchange began operations at T Wharf, Boston, removing six years later to the Boston Fish Wharf, where its headquarters are now located. Incorporated as a clearing house for fishing vessels and standardizing all registered sales, the organization is controlled by a president, vice president, secretary and treasurer, and a board of eleven directors, and in the twenty-two years of its existence it has had but six presidents—John R. Neil, William J. O'Brien, N. L. Fulham, Warren Fitch, Henry Hunt, and Edmond Dunn.

The conditions existing before its organization were chaotic and un-

businesslike, but by a policy of systematizing the trade order and stability have followed, and during the past ten years the transactions have doubled. In a single day recently 1,350,000 pounds of fish were landed at the headquarters of the exchange, and from January 1, to April 18, 1929, there were 1,710 arrivals, with 80,969,225 pounds, while during the year of 1928 there were but 1,742 arrivals, with 72,751,900 pounds of fish aboard, thus indicating that in less than four months in 1929 upwards of 8,000,000 more pounds of fish had been handled by the exchange than in the entire preceding calendar year.

The Merchants Wool Scouring Mill, incorporated in 1908, with capital of \$21,000, employs twenty-five operatives in scouring, carbonizing and assorting wool. Edmund G. Dalton is president and treasurer, and M. A. Dalton, secretary.

The Atlantic Decorating Company was established by Ernest W. Campbell, in 1909, and for twenty years thereafter until his death, in 1929, Mr. Campbell devoted his entire time to designing interior decorations for large expositions, such as the annual Boston Automobile shows, the House Beautiful, Radio, and other displays.

THE JOSEPH POLLAK TOOL AND STAMPING COMPANY, INC.

In January, 1909, Joseph Pollak, with capital of \$300, leased 400 square feet of floor space, at 215 Sydney Street, in Dorchester, where, in his individual name, he began manufacturing dies and tools. Seven years later he incorporated the Joseph Pollak Tool & Stamping Company, Inc., with capital of \$10,000 and at that time employed six men. That year, the plant was removed to 72 Freeport Street, and when fire destroyed the factory in February, 1918, the concern moved to 81 Freeport Street, and two years later bought the plant in which it was located.

It was at that time that the manufacture of electric automobile appliances and accessories, was added to the metal stamping line.

In 1925, a two-story factory was built giving the company a total floor space of 20,000 square feet. At the present metal stampings, counter and window metal display stands, and electric parts and accessories for automobiles constitute the products, and about seventy-five men and women are employed.

The company is obtaining a foot-hold in foreign markets. The corporation has capital of \$100,000. Joseph Pollak is president and treasurer, and R. R. Holub, secretary.

THE MAVERICK MILLS

In 1909, the Maverick Mills were incorporated, and today have capital of \$505,800, the plant being equipped with 130 cards, 1,198 narrow looms, forty-two cotton combs, and 73,000 ring spindles. The enterprise is the largest textile unit within the limits of Boston proper.

Noble Foss is president, Horatio Alden, clerk, W. E. Barrett, treasurer L. J. Cullen, vice president, and W. H. Paige, superintendent and the products include dress goods and fine cotton fabrics of various types.

In 1909, the Bay State Cotton Corporation, with capital of \$1,500,000 was organized as a holding company through exchange of stock, and the Lowell Weaving Company, the Warner Cotton Mills and the LeRoy Cotton Mills, were combined. In 1910, the International Cotton Mills Corporation, capitalized for \$20,000,000 combined the Consolidated Cotton

Corporation, the J. Spencer Turner Company, the Boston Yarn Company and the Bay State Cotton Corporation.

THE NEW ENGLAND POWER SYSTEM

From the time when the Peregrine White mill was started in the early Colonial days to the present, New England's industries have always obtained a very substantial part of their energy from the power of flowing water. Mills were located, of necessity, on water powers, and many industrial centers, such as Lowell, Lawrence, Manchester, Lewiston, Holyoke and scores of other cities and towns owe their existence to the "white coal" developed in their midst.

With the advent of electric generation and long distance transmission it is now possible to bring the power to the mill and the energy of New England's more remote water powers is being transported by wire to distant industrial centers.

The New England Power System was a pioneer in generating and transmitting electricity and from its various hydro-electric plants on the Deerfield and the Connecticut rivers it has for twenty years been furnishing to New England's industries adequate and dependable power. Incidentally fuel has been conserved, natural resources have been developed and new wealth has been created.

The first hydro-electric plant of the system was built on the Connecticut River at Vernon, Vermont, and was placed in operation, in 1909, with a capacity of approximately 30,000 horse-power. In 1921 additional units were added and the capacity of the plant now exceeds 40,000 horse-power. Power from Vernon was transmitted over the first long distance transmission line in New England to Gardner, Fitchburg, Leominster and Worcester.

INAUGURATING A NEW POWER ERA

In the intervening years so many high-tension towers, with their network of wires, have come into being that it seems almost incredible to the average citizen of Massachusetts to believe that it was but two short decades ago that the pioneer group—Chase, Harriman, Baker, Ayling and Young—broke down the barriers of the old hydraulic power era and inaugurated a new power era in the industrial history of Massachusetts by turning the waters of the Connecticut, and later the Deerfield River, through generating machinery and substituted the transformer for the coal pile and the power line for the water-wheel, which for nearly three hundred years had been commonly accepted as the symbol of industrial power.

Today, the New England Power Association has harnessed the majestic Connecticut, fifty miles south of Canada, on a line between the White Mountain range and Lake Champlain and has created at Fifteen-Mile Falls one of the world's greatest hydro stations.

Famed for three centuries as an artery of commerce, between the timberlands of northern New England and the Atlantic seaboard, the "Mother of Waters" of this section now assumes its place beside the Mississippi, the Susquehanna, the Alabama, the Colorado, the Hudson, the Saluda, and the Niagara rivers as a major source of hydro-electric power.

To the Vernon development of 1909 goes the honor of establishing the principle that widely separated geographical areas might be interdependent one upon the other and that the transmission line could bind producing and consuming centers into a system served by steam and water.

Until that year it had seemed chimerical to believe that shafting could be turned in the textile centers of Bristol County and could be operated by power developed on the remote Connecticut. Conversely, it was not thought that the distant powers of this river and of the Deerfield could find a market large enough to warrant hydro-electric installations—because there were doubting Thomases in those days as there are now.

But the practical demonstration at Vernon ended these doubts, and demonstrated that whereas in the day of hydraulic power such enterprises as served but one locality, a single hydro-electric development could supply many communities, and that the number supplied mounted by geometrical progression as the number of developed powers increased.

Following the Vernon experiment, the New England Power Association obtained extensive water rights on the Deerfield River, and in 1912 placed in operation three hydro-electric plants located, near Shelburne Falls, in this state, with an aggregate capacity of 30,000 horse-power. This was followed the next year by the completion of the Somerset Reservoir, in the head waters of the Deerfield, which greatly conserved flood waters and equalized the flow of the stream.

In 1915 the so-called No. 5 Plant near the Hoosac Tunnel, in Massachusetts, was placed in operation, with a capacity of 24,000 horse-power, and the pre-war construction ended the following year with a small plant at Readsboro, having a capacity of 4,000 horse-power.

POST-WAR PROGRESS

Following the close of the war the development of the Deerfield River was resumed and, in 1922, a 6,000 horse-power plant was finished near Searsburg, Vermont. During the next two years the Harriman Plant and Reservoir near Whitingham, Vermont, was constructed, and formed what was then the largest development of the system, with an installed capacity of 60,000 horse-power and a usable storage of approximately 5,000,000,000 cubic feet of water. The dam of this plant is a two hundred-foot earth structure, from which leads a three mile tunnel to the power plant, near Readsboro. The Sherman Plant was finished in 1926, with an installed capacity of 10,000 horse-power and ends for the present the development of electric energy on the Deerfield River, which has two large storage reservoirs and seven plants, with an aggregate head in excess of 1,000 feet. It forms one of the most unique hydro-electric developments in the world, and probably no stream in any land is better conserved and handled than the Deerfield.

In 1928, the New England Power Association completed a large modern plant on the Connecticut River, at Bellows Falls, which well emphasizes the difference between the old fashioned water-plant, in which the power was used directly on the wheels of the mill, and the modern electric plant producing energy for transmission to distant industrial centers.

The plant at Bellows Falls has a capacity of 60,000 horse-power and brought the total installed capacity of the hydro-electric plants of the

New England Power Association to 230,000 horse-power, enabling them to produce annually approximately 650,000,000 kilowatt hours for the use and benefit of New England's industries.

The growth of the load of this system has been so rapid that the construction of two large hydro-electric plants, at Fifteen Mile Falls, on the upper Connecticut River was begun in 1928. These two plants have a combined head of approximately 300 feet, a storage capacity of 6,000,000,000 cubic feet, and are capable of generating each year 450,000,000 kilowatt hours, with an installed capacity of 225,000 kilowatts. The cost of these plants was in excess of \$40,000,000.

In addition to its hydro-electric plants the New England Power Association has several large steam plants, the largest being the station of the Narragansett Electric Company, in Providence, with a generating capacity of over 100,000 kilowatts. The next in size is that of the United Electric Railway Company, with a capacity of 50,000 kilowatts while the system owns other large steam units in Uxbridge, Lowell and Lawrence, the combined steam capacity being well in excess of 200,000 kilowatts.

High tension transmission lines have been constructed from all of the various hydro-electric plants to its industrial market in central New England, which extends from Providence, R. I., on the south, to Nashua, N. H., Bellows Falls, Vt., and to the Canadian line, on the north, and from the New York state line on the west to the Boston Edison territory on the east. The system comprises not only the three main generating and distributing companies, to wit, the New England Power Company, the Connecticut River Company, the Bellows Falls Hydro-Electric Company, and the Rhode Island Power Transmission Company, but also many of the leading utility companies of New England, such as the Narragansett Electric Company and the United Electric Railways Company, both of Providence, The Lowell Electric Light Corporation, the Lawrence Gas & Electric Company, the Quincy Electric Light & Power Company, the Gardner Electric Light Company, the Webster & Southbridge Gas & Electric Company, the Hartford Water Company, the Seekonk Electric Company, the Grafton County Electric Light & Power Company, the Fall Mountain Electric Company, the Worcester Electric Light Company, and the Mascoma Power System. The system is also connected with most of the large electric utilities of New England, including the Edison Electric Illuminating Company of Boston, the Fitchburg Gas & Electric Company, the Eastern Connecticut Power Company, the Mohawk Hudson Electric Company, the Twin State Gas & Electric Company, the Turners Falls Power & Electric Company, and the Public Service Company of New Hampshire.

To these companies it sells large blocks of electric power and from them it also purchases many kilowatt hours of steam relay. The New England Power system is in reality the super-power system of New England, tying together practically all of the large hydro-electric and steam-generating plants of central and southern New England and making it possible for these plants to coöperate in furnishing to the industries of the six northeastern states the most dependable and economic power which the section can produce.

The output of the system already well exceeds 1,250,000,000 kilowatt hours and is growing at a rate of approximately 10% per annum. The

New England Power system is indeed one of the great factors in New England's industrial development and has added much to her industrial prosperity.

PHENOMENAL PROPERTY INVESTMENT

All this development proceeded so quietly and without the blare of trumpets that even well-informed observers failed to realize the extent of the accomplishment of the last twenty years, and especially what has transpired during the post-war decade.

Since the initial operation of the system's first Connecticut River hydro station, at Vernon, in 1909, the property investment of the units now comprising the New England Power Association has grown from \$15,000,000, which figure does not include the properties consolidated in the United Electric Railway Company, a subsidiary of the Rhode Island Public Service Company, acquired in 1921, to over \$188,000,000, an increase of \$173,000,000. The money represented by this increased valuation would pay the cost of building the proposed dam and generating station at Boulder Canyon on the Colorado River with \$100,000,000 left over, or the entire Boulder Dam power-flood control-irrigation project with \$20,000,000 left over. And Fifteen-Mile Falls, which represents the investment of an additional \$40,000,000, is not included in the \$188,000,000 figure.

There is no hydro-power electric development in the United States—not even that at Niagara Falls, that can boast of the head of power existing at the Harriman Plant, on the Deerfield. To utilize the 390-foot head to the full a great power tunnel was bored through to Harriman, and it is significant that while that station has nothing like the great water supply that feeds into the company's turbines at Bellows Falls, it develops exactly the same number of horse-power. The answer is that while the Deerfield cannot compete with the Connecticut in terms of volume, it can and does drop a much greater distance than the mother stream at Bellows Falls.

The head at the major Niagara Falls development of the Buffalo, Niagara and Eastern Power Corporation, Schoellkopf Station 1 is but 214 feet.

The Fifteen-Mile Falls plant is a dual development.

Twice the Connecticut is blocked in its downward rush by dams and generating stations, producing a situation not unlike that on the Susquehanna at Conowingo and Holtwood with the reservoir of one backing up against the tailrace of the other. But on the Pennsylvania stream the two developments—to which will be added a third—represent projects having little or nothing in common except geographical proximity, whereas the Fifteen Mile Falls Developments comprise a single project. Two reservoirs, two dams and two generating stations all yoked in hydro-electric harness, operating together and feeding 300,000 horse-power into the highest pressure transmission system in New England, operated at 220,000 volts, double the pressure of the Bellows Falls-Millbury line and double that employed along the main line from Boston and Millbury to Buffalo and 2.4 times more horse-power than is developed at the combined stations on the Deerfield, including the Harriman plant, and 11.9 times more than the famous Vernon installation, of 1909.

THE PRESENT PICTURE

In 1928, the earnings and production of the New England Power Association established new records, and all the operating companies reported increased gross revenue from electric sales, despite many reductions in rates. An increased amount of power was sold to other public utility companies, and with the exception of the textile industry, consumption by the larger industrial consumers was substantially greater than in 1927.

The Association's electric production for 1928 increased 28.4% to a total of 1,384,834,000 k. w. h., and its electric sales increased 26.8% to 1,091,901,000 k. w. h., (excluding the power used in the system's own railway operations). The output of its hydro plants was above normal on account of the record rainfall during the first nine months of the year and each plant exceeded its previous record for output. Hydro generated power, including purchased power, amounted to 804,000,000 k. w. h. of which 86.5% were generated by the plants in the system. This hydro power amounted to 58% of the total production compared with 51.5% in 1927.

Further arrangements for the pooling of power resources of the Edison and New England Power systems were effected in 1928, which it is expected will prove of great benefit to the consumers of each system and a third physical connection between the New England Power System and the Edison Company was brought about.

A total of \$8,295,300 was expended for new construction on various parts of the system, that year. The maximum demand was 315,000 kilowatts as against 270,000 in 1927, and its customers increased 29,560 during 1928. New substations at Tewksbury, Pratt's Junction and Field's Point were completed, new office buildings were opened in Lowell and Southbridge, while a consolidation of the system's executive, operating and engineering organizations were brought about in new offices in Boston, the former offices at Worcester being transferred to the Hub. A contract was entered into with The Edison Electric Illuminating Company of Boston for the purchase by it of 150,000,000 kilowatt hours of electricity annually for ten years and for broad interchange arrangements.

The total income of the system reached \$31,835,604 in 1928, an increase of more than \$3,000,000 over the previous year. In May, 1929, the company reported an output for that month of 136,402,000 kilowatt hours, an increase of 19% over May, 1928, and 58% over May, 1927. The May, 1929 output established a new high record for a single month's production, and reflected the inclusion of the output of the Worcester Electric Light Company which was acquired the first of that month. In the first five months of 1929, the output was 638,514,000 kilowatt hours, 15% greater than in the corresponding period of 1928, and 46% greater than in the first five months of 1927.

Its output in the first four months of 1929 was 15% over that of the same properties in the first four months of 1928. This compares with an increase of 12% by all public utility power plants in the United States as reported by the United States Geological Survey.

The officers of this great corporation are: president, Frank D. Comerford; vice president and general manager, Samuel C. Moore; vice presidents, A. R. Graustein, A. E. Pope, W. C. Bell; secretary, F. J. Dunn;

assistant secretary, R. S. Pattee; treasurer, Carl S. Herrmann; assistant treasurers, H. Hanson, F. P. Jackson, Jr.; general auditor, W. C. Coburn; chairman of the board, Charles L. Edgar; vice chairman of the board, Henry I. Harriman; directors, E. B. Aldrich, C. L. Ayling, G. B. Baker, W. C. Baylies, J. J. Bodell, W. R. Callender, Jonathan Chace, M. G. Chace, F. D. Comerford, C. L. Edgar, Samuel Ferguson, L. C. Gerry, A. R. Graustein, H. I. Harriman, J. T. Hutchings, John Johnston, J. R. Macomber, S. C. Moore, Rudolf Pagenstecher, J. J. Phelan, Philip Young.

COOPER-WILLIAMS, INC.

In 1910 Ernest R. Cooper who at that time was the head of the decorating department of the William C. Safford Company, of Boston, and Donald D. Williams, who was also connected with the Safford Company as financial manager formed the business known as Cooper-Williams, Inc., but with no idea at the time of manufacturing furniture. Small offices were established at 5 Park Street, where the concern continued an interior decorating business until 1916, when it moved to 284 Dartmouth Street and occupied a remodelled four-story residence, next to the Hotel Vendome.

Almost all the furniture used by Cooper-Williams, Inc., between 1910 and 1915 was designed by Mr. Cooper and in the latter year a small factory was secured and a wholesale department added. In 1924 the business had grown to such an extent that the building on Dartmouth Street was given up, and the entire efforts of the organization centered on the manufacture of furniture, which has since been carried on in a thoroughly modern factory, occupying an entire block between Wareham and Malden streets, at 495-527 Albany Street. Extensive New York showrooms have been maintained at 385 Madison Avenue, since 1924, and for several years previous to that at West 47th Street. A Chicago office was established in 1927.

In 1923 Donald D. Williams retired, selling his interest to Clifford Harrington, who is now the treasurer and secretary and in charge of the New York salesrooms. Mr. Cooper is president of the corporation, which has capital of \$70,000, and Lillian G. Askin, assistant treasurer and secretary.

THE CRAFTEX COMPANY

Just about a score of years ago Walter B. Allen, a well-known Boston interior decorator, began a series of experiments designed to find a material that would give to modern walls the "texture" observed in the old Italian and Spanish palaces of Europe, and eventually producing a combination of finely ground mica, English white clay, and casein, that ancient binder derived from milk and used by the Egyptians and Romans, he secured the effect he strove for.

In 1911, Craftex, the first "plastic paint," came into being, and Mr. Allen, with E. H. Hall, formed the Alinall Manufacturing Company to manufacture the commodity. From that year until 1922, Craftex was marketed exclusively by the Allen-Hall Company, but on January 22, of the latter year, Albert D. Simmons and Hartley B. Gardner formed the Simmons-Gardner Company to merchandise the product, a desk and a couple of chairs constituting the office equipment at that time. In April, 1922, David Murray, then connected with the Stedman Products Company became identified with the Simmons-Gardner Company and immediately

there was launched a campaign to educate painters, architects and home owners, and consumer advertising was begun. In August, of that year, a New York office was opened at 101 Park Avenue which was moved to 285 Madison Avenue in 1926.

In January, 1924, the Simmons-Gardner Company became the Craftex Company, and the latter concern acquired the manufacturing rights from the Alinall Manufacturing Company the plant being removed to a small factory at 159 Harvard Street, Cambridge. Later another plant on Hampshire Street, in the same city, was occupied to take care of the increased production. In June, 1924, an office was opened in Chicago.

In September, 1925, the Chemical and Research department was established, and a foresightedness which has proved gratifyingly sound, was the organization of a department on Decoration and Design with Miss Jeannette Kilham as director.

In January, 1927, just five years after the Craftex Company was formed, it moved into its new factory on Antwerp Street, Brighton, equipped with machinery capable of ten times the production possible in the former plant. In addition to Craftex, Craftexsize, and Craftcoat (the two latter products being specially prepared for the sizing and glazing of Craftex), the company has added "Sunflax"—a lithotone paint with a casein binder, soluble in cold water. This product, like Craftex, is the first of its kind in the market, and its light reflection value—over 90%—is the highest known in the paint industry.

In 1927, the International Craftex Company was formed for the purpose of marketing Craftex abroad. The growth of this part of the organization has been rapid, dealer representation being already established in more than a dozen foreign countries with Craftex installations in almost every quarter of the globe. In May, 1928, a Canadian factory was opened.

Late in 1928 a major financial interest in the Craftex Company was acquired by the Bemis Industries, Inc., of Boston, but the policies and personnel of the former company remain unchanged by this affiliation. The company's products grace public and private buildings in England, France, Japan, Siam, Cuba, Australia, Canada, and many other foreign countries. David Murray is president, Charles N. Eaton, vice-president, and Hartley B. Gardner, treasurer. The company employs upwards of 100 persons.

In 1911 the American Core Twine Corporation, was incorporated and is engaged in the manufacture of clothes line and fleece line, paper twines, cords, reeds and yarns. Henry W. Buhler is president and treasurer. The concern has capital of \$115,000 and employs sixty operatives.

STANDARD OIL COMPANY OF NEW YORK

One of the ablest and most notable industrial leaders raised in Massachusetts, during the nineteenth century, was Henry H. Rogers, who was born at Mattapoisett, January 29, 1840, and who, at the age of thirty-four established himself as not only a leader in American business affairs, but as the one man who possessed the vision and strength of character to project and consummate an alliance of the leading oil refineries of the Cleveland-Pittsburgh and New York districts, which eventually led to the formation of the original Standard Oil Company, destined to become the best known industrial, commercial and financial enterprise in the

world, and which served a great and useful purpose in the economic life of the people of all lands.

As Mr. Rogers once truly said of this child of his brain: "It steadily carried light and comfort to those who before sat in darkness."

Criticized and abused to a degree such as were but few men of his time, and subjected to searching public and private investigations he steadfastly held to his belief that the trust he was charged with creating was nothing more than "a combination of ideas, backed by capital."

Poor and unknown, all that H. H. Rogers had to work with at the outset of his career were his hands and a clear brain, and by the sheer power of his personality, he grew to a position where he became the guardian of countless millions of dollars, and the creator of agencies whose operations have ministered to the welfare of millions of people in every land under the sun.

To him, New England owes much, as the Standard Oil Company of New York, which has served this territory since 1911 when as one of the original Standard Oil group, it was allotted the New York-New England marketing area, was one of his creations.

It early adopted the policy of intensely cultivating its domestic territory, which augmented by consistently large advertising budgets, has made a household word of its well-known trade name, "Socony," whose stations dot every improved highway in the seven states it primarily serves.

In 1912 following the segregation of the oil companies in the Standard group it had few manufacturing facilities, but it did not possess any directly owned crude production, although Magnolia Petroleum, then its subsidiary, was beginning to develop production.

The latter, now fully owned by Standard Oil Company of New York, has been and still is the principal source of its crude supply for its eastern seaboard refineries and of a large part of its refined products.

Essentially a marketer and a big buyer of petroleum products from other companies, and buying as close to points of consumption as was possible, increasing competition developed in various markets following the war as other oil units expanded their territories.

It was not long before the company took steps to strengthen its strategic position in supplies of crude oil and other products. In 1925 it acquired a minority interest in Magnolia Petroleum Company and in the following year, ownership of the General Petroleum Corporation.

It is noteworthy, in this connection, that both acquisitions were properties whose crude oil and products could be easily shipped by water. Magnolia's facilities in Texas permit easy shipment to Europe as well as to the East Coast of the United States, while General Petroleum's position in California placed Standard Oil of New York in the big Pacific Coast market as well as affording it facilities near the Far Eastern markets.

The physical operations of the properties show enlarged activities by the two subsidiary units in the production of crude oil, pipe line transportation and refinery operations. The parent company was never a factor in either production or pipe line transportation, and in recent years its refinery operations have been decreasing in the amount of gasoline, kerosene and fuel produced though the production of lubricants has expanded.

In two departments—production, and pipe line runs—a high record was set in 1928, although refinery yields were somewhat lower than in sev-

eral recent years, indicating larger purchases from other companies. In 1928 net crude production passed 100,000 barrels daily average for the first time, while pipe line runs of 169,000 barrels a day made a new high record, and were more than double those of 1921.

The producing operations of Magnolia Petroleum are mainly in Texas, Oklahoma, Kansas, Arkansas and Louisiana with some production in Mexico and prospective oil lands in New Mexico and Colorado. Its 6,704 wells are producing from 8,179 acres in fee and 200,760 leased acres while non-producing areas consist of 78,216 acres in fee and 2,651,961 under lease. General Petroleum's production is entirely in California from 928 wells on 7,231 acres in fee, 2,435 acres of government leases and permits and 3,875 leased; non-producing areas consist of 27,793 fee acres; 3,821 government permits and 25,594 leased in California; 11 fee acres and 93 leased in Mexico and 2,160 leased in Utah.

The pipe line system is in two major groups, that of Magnolia Petroleum having trunk line delivery capacity for 136,000 barrels daily to the Gulf Coast; General Petroleum's lines in California having delivery capacity for 100,000 barrels daily to its main refinery, at Vernon, and from that point to sea-loading terminals of 50,000 barrels daily. Magnolia has 3,668 miles of trunk pipe lines and 1,892 miles of gathering lines; General Petroleum has 471 miles of main and 174 miles of gathering lines.

By pipe lines and ships, crude oil is moved to twelve refineries, all located on or near the Atlantic seaboard, the Gulf Coast and the Pacific slope. They have an aggregate capacity of 206,500 barrels of crude oil daily. Though General Petroleum's four plants with 97,500 barrels capacity form the largest group, they are not completely equipped for cracking crude oils.

Magnolia's five plants with capacity for 75,000 barrels daily secures larger yields from the crude. Its 55,000-barrel plant at Beaumont recovers all products, including lubs, wax and grease; it is equipped with 44,000 barrels cracking capacity and 12,000 barrels additional cracking have recently been installed.

The parent company has three plants aggregating 34,000 barrels capacity, the largest being the complete plant of 19,000 barrels capacity in New York Harbor; the Providence, R. I., plant has a capacity of 10,000 barrels and the Buffalo plant of 5,000.

Standard Oil Company of New York's domestic marketing operations cover seventeen states and Alaska while its foreign operations are conducted in China, Japan, India, Turkey, South Africa, Jugo Slavia and Australia.

In domestic marketing the parent company handles the six New England states and New York, and in these areas it has 507 wholesale plants in all principal cities and 1854 retail gasoline stations.

Its dealer organization is far in excess of the company-owned retail distribution, recent figures showing 70,000 points of distribution for Socony in New York and New England.

Magnolia Petroleum markets in the southwest with 873 tank wagon storage and distributing stations and 514 gasoline service stations. It distributes throughout Texas, Oklahoma and Arkansas and at points in New Mexico, Louisiana and Kansas. General Petroleum does not distri-

bute direct and at retail through service stations of its own, but serves dealers in California, Oregon, Washington and Arizona through sixty-four bulk plants and in Alaska it has one bulk station.

To handle this far flung marketing operation, Standard Oil Company of New York and its subsidiaries have a large amount of marine equipment. The Standard Transportation Company (Delaware) and Standard Transportation Company (Hong Kong) own forty-eight tank steamers, seventy bulk barges, eleven motor bulk barges, five barges, two bulk launches, 117 deck barges and twenty-seven tugs. These have combined carrying capacity of 4,082,000 barrels and 906,000 cases. In the parent company's foreign and domestic marketing and in the domestic marketing of Magnolia and General Petroleum there are operated six river steamers, ninety-nine lighters and barges, seventy-six tugs and launches and 116 junks and sampans, the latter for Chinese operation.

With ownership of General Petroleum, Standard of New York is in better position to move refined products across the Pacific to Far Eastern markets; also, as desired, to move crude oil and products by tankers on intercoastal route through the Panama Canal to the eastern seaboard of the United States. General Petroleum's facilities permit movement of both crude and refined products to the eastern seaboard, and of refined products to European and African markets.

Standard of New York has been among the leading money makers of the oil group for several years. Its profits in 1928 were, except for 1926, the largest in any of the past six years. Its dividend distributions have been rather liberal, payments in 1928 and in 1926 representing 70% of net after reserves; like several other oil units, it did not earn its dividend in the subnormal year of 1927.

The New England headquarters of the Standard Oil Company of New York are located in the Park Square Building, Boston.

THE CYNTHIA MILLS

In 1912 Charles L. Harding, William C. Reynolds, Nathaniel F. Ayer, and others associated with the firm of Harding, Tilton & Co., incorporated the Cynthia Mills, and began converting cottons and worsteds for crochet and embroidery uses, locating its plant in East Boston. The concern has made steady progress and has consistently paid dividends to its shareholders.

In 1926 the ownership of the stock controlled by Charles L. Harding was transferred by purchase to William C. Reynolds, who became the majority stockholder. He is president of the corporation, and Anson H. Smith is vice president, John L. Barry, treasurer, and these three officers, with Conrad W. Hobbs and R. R. Barry, constitute the board of directors.

The volume of sales developed by the concern keeps the plant in constant operation, and upwards of 100 operatives are employed. The corporation has capital of \$96,000.

In 1912 the Armstrong Knitting Mills were incorporated and at the West Roxbury plant upwards of 150 operatives are employed in the manufacture of men's, women's and children's worsted angora sweaters and sweater coats. The corporation has capital of \$200,000. R. W. Armstrong is president and treasurer, Harry B. Green, vice president and A. C. Crowley, secretary.

THE SHIPMAN MACHINE COMPANY

In 1913, the Shipman Machine Company was established to carry on general machine repairing, and to manufacture bottle labeling machinery. At the outset five hands constituted the working force. In 1925 the concern acquired the Boston Bottle Wiring Labeling Company. Peter A. Conway is president, and James H. Conway, treasurer, and general manager.

The Boston Braid & Trimming Company was incorporated in 1913, and employs thirty-five operatives in the manufacture of dress and cloak trimmings and braids, the plant being equipped with narrow and Jacquard looms, winders, braiders and knitters.

Paul J. Cramer and Hugo Weinstock are the present partners.

THE F. E. ROLLINS COMPANY

The National Remedy Company was organized on April 7, 1913, to manufacture what has since been found to be a penetrating germicide, which by chemical combination with their poisons destroys the bacteria that causes most of the major diseases which afflict humanity, such as pneumonia, tuberculosis, bronchitis, influenza, external blood poisoning, etc. At that time, only a few bottles had been sold as a liniment, and the product is now known as B. & M. External Remedy.

The preparation is based on a formula said to have been discovered by a well-trained physician and chemist after he had retired from the active practice of medicine, and while spending a part of his leisure time in laboratory experiments. Instead of following the theoretical practice of turning his discovery over to the medical profession, he allowed it to pass into the hands of a layman, thereby putting it into the proprietary medicine class and under the ban of professional medical ethics. During the succeeding fifteen years or more, it was not offered to the public.

Shortly after the transfer of the formula to the National Remedy Company, the germicidal efficiency of the preparation was discovered by its use in the case of a woman suffering from tuberculosis in a far-advanced stage. Not only was the inflammation relieved, but continued use resulted in complete recovery from the tuberculosis.

Strenuous, but unsuccessful efforts, were made to secure tests by recognized medical authorities and have the results made known to the public, while ordinary advertising channels were not available because publishers refused to advertise a remedy for tuberculosis.

After much effort, a sufferer from tuberculosis, who had abandoned every other hope was persuaded to experiment with the remedy, and the astonishing results were repeated from month to month. Recoveries multiplied and the recommendations have now reached into every state in the Union and to some foreign countries.

Medical officials assumed that the remedy was a fraud, which should be suppressed by the courts and actions were brought. A justice of the Municipal Court of Boston, a jury in the Superior Court of Massachusetts, and another in the U. S. District Court at Concord, N. H., found that the company's claims as to the efficiency of the preparation in germ diseases were not untrue.

Actual use of the product demonstrated that the preparation is a penetrating germicide, but the whys and wherefores of its action, as well as the extent of its efficiency, were unknown. During the past five

years in a well-appointed laboratory, and during the past two years in a clinic conducted according to the highest professional standards, these problems have been studied with astonishing results which will soon be published. The research work is still going on and upwards of \$50,000 has already been expended along this line but the end is not yet.

During the first nine years of the existence of the company, the total loss of the business was \$9,630.60, which sum was contributed by the treasurer from his personal earnings outside of the business. The yearly sales began to grow to large proportions about 1920 and last year were \$140,714.62.

Another National Remedy Company, located in New York, which manufactures proprietary medicines, produced a confusion in accounts and made it desirable that the name of the Boston concern should be changed. The New York unit having been long established, was entitled to its corporate designation and in February, 1929, the Boston concern was changed to the F. E. Rollins Company, of which F. E. Rollins is treasurer.

THE PROSPECT, BANNER AND SIGNAL SHOE COMPANIES

An insatiable desire to succeed, and the constant memory of a promise made to his mother, back in a bleak Russian town, carried one of Boston's leading shoe manufacturers from comparative poverty to the enviable position he now holds.

The story is of Isaac Feldman, president of the Prospect Shoe Company, which operates three modern shoe factories in Boston, who was born in 1885, near Kiev, Russia, the son of a Jewish tanner. At the age of twelve, Isaac Feldman went to work in his father's tannery in Novograd Volinsk where he sorted leathers, learned much of kid-skins and calf, and for six years until his father's death, continued to absorb leather knowledge. At the age of eighteen, with the family fatherless, he came to the decision that no longer could he or would he bear the yoke of suppression which galled Russia's entire Jewish population at that time. He would come to America, and find freedom of work and expression, and earn a living for himself and the family. But his mother did not share his eagerness, and every maternal objection she could think of was voiced, by her until finally she succumbed to his pleading, and handed him all that the family finances could afford for such a venture.

He left the home city with 120 roubles—at that time the equivalent of about \$60 in American money—and, after a long talk with the ticket agent, decided upon Lynn, Mass., as his objective. Embarking on a ship for Canada, in November, for fourteen stormy days and nights he lived on herring and black bread in the steerage of a combined freighter and passenger steamer, next to the stable quarters of a long string of restive, frightened Belgian draft horses.

From Canada he entrained for Boston. Knowing no English, his proficiency in Russian, Polish and Yiddish helped him not at all when he reached the Hub. An express tag tied in his coat lapel bore the legend: "I. Feldman. To Lynn, Mass., U. S. A.," with the accompanying address of a distant relative who kept a boarding house in Lynn.

The friendly, Irish smile of a big, blue-coated, Boston policeman gave the young man courage to show the tag to the guardian of the law. "That policeman," related Mr. Feldman, "was the first I had seen in America. He took me by the arm, smiled to let me know he was going to help me,

and took me out to Causeway Street. He waited until a Lynn car came along, told the conductor about me and where I wanted to go. Of course, I couldn't understand a word of it, but I was on my way to Lynn."

When young Feldman reached his destination, he had \$2.85 in his pocket, and three weeks later he received a job as a laster in a factory at West Lynn, but being inexperienced he earned no money until the fifth week, when he expected to receive \$2.40, but the firm deducted \$1.80 to cover the damage he had caused to two pairs of shoes in the lasting process. For a year he worked in this factory and then moved on to a bit better job in another local plant where one winter morning, during a howling northeast blizzard, he arrived fifteen minutes late, which excusable delinquency resulted in wordy altercations with two foremen, who proceeded to throw him down a flight of stairs after he had hurled a shoe at one of them.

Securing his pay, settling what small debts he had incurred, he took account of stock, and found he had about \$5 remaining in cash, the clothes he wore, and the shoes on his feet. He determined to be his own boss henceforth, and interviewing Levine Brothers, a Boston wholesale firm, he proffered his capital, received a package of shoe laces, collar buttons and cotton handkerchiefs, in return for his \$5, and obtaining permission to occupy one side of a Lynn shoe merchant's doorway, put in a busy Saturday afternoon until 4 o'clock when he had disposed of all his stock at net profit of \$4. The next Monday Mr. Levine suggested that Feldman add to his line, and six rugs were taken by him on consignment, and sold following a door-bell campaign. On Wednesday another half dozen were disposed of by him, his first week's work netting \$18.

Throughout the following year he kept up his rug and small-wares business, but his mind was on leather, and he was figuring out ways and means to get back into the business he best knew and loved. At last he made up his mind that he could make a success dealing in scrap leather and on a hot day in July he bought his first lot of remnants, weighing fifty pounds or more, jumbled together in a bag which he slung over his shoulder. The bag was emptied before night and he found he had made \$3 profit.

He went to Peabody and bought sheep-skin tear-offs, where he formed a warm friendship with P. J. Harney, of the P. J. Harney Leather Company. Isaac Feldman's business was prospering; he knew how to buy and sell old stock, and he built up a respectable surplus.

Then came 1914—the year of the outbreak of the World War. Sticking to the old leather stock business, Mr. Feldman continued his upward progress, and before the armistice was declared, he and his business were worth about \$35,000. But around the corner, fate was waiting with a club. Shortly after the war leather dropped out of sight, and Isaac Feldman's stock was worthless. On the Wednesday following the armistice, he came to Boston and tried to sell what he had at half price. But there were no customers.

Mr. Feldman paid his creditors and found he had a balance of \$218 when it was all over. A few days later he sold a small quantity of leather at 11 cents, for which he had paid 55, but the amount added a bit to his working capital. It was then that he decided to make comfort shoes, and he produced from four to five cases a day. The firm of Dungan, Hood & Co. believed in his business acumen and extended liberal credit to him.

When conditions appeared at their worst at one week-end, help came from a competitor. Friday afternoon of that particular week showed a pitifully thin bank balance. The pay roll was due on the morrow. The accounts were paying slowly. Harry Lyons, of Lyons & Hershenson, competitors of Feldman, was called on the telephone and asked if he could supply a loan of \$2,000. That afternoon Mr. Lyons appeared at Feldman's factory with \$4,000 in greenbacks. "I only wanted half that," said Mr. Feldman, "Harry, why the \$4,000? I only need \$2,00," he added; whereupon Mr. Lyons replied: "I'm making it \$4,000 today so you won't bother me next week." When the loan was paid the following month Lyons refused to accept any interest.

Feldman next experimented with shoe novelties and with rapidity the business expanded until today the founder owns and operates the Prospect, Banner and Signal Shoe Companies. In January, 1928, the Prospect and Banner units were moved from the old location in Federal Court to the fifth and sixth floors of the new Harbor Building, at 470 Atlantic Avenue, an ideal plant particularly from the workers' standpoint. These two factories turn out a total of 2,200 pairs of novelty shoes daily.

In 1913 the New England Southern Mills were incorporated and have their headquarters at 24 Federal Street. The corporation operates plants in Lowell, in this state, and in Hogansville, Ga., La Grange, Ga., and Lisbon, Me., and controls other plants at Tucapau, S. C., Hogansville, Ga., and Pelzer, S. C. Allen McNab is president, and A. L. Scott, treasurer.

THE BERRY-WALKER COMPANY

On January 2, 1915 Clifton E. Berry and Hugh L. Walker incorporated the Berry-Walker Company to manufacture apparel for nurses and maids, including aprons, collar and cuff sets, caps, coverall uniforms and Hoover garments, the business being established at 79 Sudbury Street, and being removed to 655 Atlantic Avenue, in August, 1919.

Starting with six employees, the concern now utilizes the services of 140 men and women. Originally only white apparel was produced, but today while 75 per cent of its product is of that color, garments in the pastel shades and house aprons in figured dimities and batistes are manufactured, the company's distribution covering the entire United States and Canada. It imports fine cotton fabrics, embroideries and laces from Europe for its higher made products, and uses domestic cotton materials from the popular and middle priced commodities. Sales offices are located at 655 Atlantic Avenue, Boston, and 320 Fifth Avenue, New York City. Clifton E. Berry is president, and Hugh L. Walker, treasurer, and 125 hands are employed.

THE PORTLAND ELEVATOR COMPANY

In 1915 the Portland Elevator Company began business in Boston, having been preceded by the Portland Company of Portland, Me. At the outset, only the repair of elevators was carried on by the new concern, but in 1916 a freight elevator machine was developed, and proved to be successful. The following year the company installed its first passenger elevator, and since that time rapid strides have been made by the concern. Up to 1929 more than 1,300 freight and passenger elevators had been made and installed by the company, of which upwards of forty each are used by two Boston corporations, while twelve constitute a part

of the equipment of the American Optical Company's plant, at South-bridge. Of the company's customers, upwards of 90 per cent place repeat orders.

During the World War the facilities of the plant were entirely given over to the manufacture of shells for the U. S. Government. The line of production includes electric, sidewalk and plunger elevators, orchestra pit lifts, dumb waiters, and console lifts, and the company manufactures apparatus for every load and speed up to 600 feet per minute, having completed elevators from 100 to 40,000 pounds.

The partners are Arthur and J. W. Radcliffe, and the concern employs forty operatives.

The Globe Knitting Company incorporated in 1915, with capital of \$35,800, employs seventy-five hands in the manufacture of children's sweaters, Teddy bear and scarf sets and novelties, the plant at 575 Albany Street being equipped with seventy-five knitting and sixty sewing machines. D. M. Gold is president, Frank Stoloff, vice president, and William Sedlis, treasurer.

In 1915 the Sweetland Waste Company, Inc., was incorporated, with capital of \$30,000 and at its plant, at 134 Tudor Street, South Boston, manufactures wiping waste. Philip Benson is president, and William A. Graham, treasurer.

THE AMERICAN PIPE BENDING MACHINE COMPANY, INC.

To bend steel, iron, brass or copper pipe without cracking, crimping or weakening was formerly, and is today, regarded as one of the most difficult problems in pipe-fitting work. To avoid this, when possible, it was customary to use an elbow joint with time-wasting cutting and threading. When bending seemed necessary, resort was had to heating or filling with sand, rosin or melted lead. This problem was solved quickly with the invention of the "Wonder Pipe Bender," in 1915, when the first patents were granted to the American Pipe Bending Machine Company, Inc., which were followed by supplementary patents five years later.

In the intervening period the business of the concern has grown to such an extent that it is today the largest manufacturer of pipe bending machinery in the world. All production is carried on under contract, and includes hand and motor operated cold pipe bending machines and bending tables.

The corporation has capital of \$100,000 and in addition to the installation of the company's products in upwards of 7,000 of the largest industrial plants in the United States, they are found in the experimental plants operated by the United States Government and by nine foreign nations, as well as in the Massachusetts Institute of Technology and five other American colleges.

Edmond P. Blake is president and treasurer of the corporation.

THE CENTRAL SHOE COMPANY

The ambition of a twelve-years-old native of the far-off province of Minsk, in pre-war Russia, to own a shoe factory, brought Jacob Eisenstatt to these shores in 1913. He knew little or nothing of American methods of shoe manufacturing, and absolutely nothing of American factory management, of selling or distribution, or of any other elements

of business in this country. But he possessed courage, a keen mind, a thirst for knowledge, and an ambition to succeed.

Eisenstatt overlooked no opportunity to learn, and what he learned, he absorbed; what he absorbed, he put to use. Arriving in Boston, he went at once to Lynn, where he secured a job as a cutter of uppers. But he did not care to remain always a cutter, no matter how swift and clever his work might be, and so he negotiated with the owner of a little contract-stitching plant to finish some shoes for him. With his savings he bought some leather, and evenings in his room he would, from his own hand-made patterns, cut the uppers of novelty shoes styled by himself. The next morning he took the finished cut uppers to the contract stitcher. A case of shoes would be finished, and then sold by the eager and ambitious young shoe cutter from Minsk to buyers, this work continuing for three years.

In 1916, with a partner, he launched a shoe manufacturing concern, which turned out five to six cases a day, and was known as the Central Shoe Company. By 1918 it was making twenty-five cases a day, and today it ranks as one of the larger shoe-producing concerns in Massachusetts, turning out 100 cases of smart novelty shoes for women each working day. Mr. Eisenstatt is not only president and treasurer of the Central Shoe Company of Roxbury, but he is also treasurer of the Rebot Shoe Company of Marlboro, treasurer of the Prime Shoe Company of Roxbury; treasurer of the I. M. Kaplan Leather Company, of Boston, and president of the Traders Finance Company, of Boston.

BARROWS & CO., INC.

On January 3, 1916 the National Engineering Corporation was incorporated by Frank G. Barrows, of F. G. Barrows & Co., of Boston, and Capt. Thomas B. Doe, general manager of the United Cartridge Company, of Lowell, for whom the former concern had built two complete plants the previous year. F. G. Barrows was also a partner in the management concern of T. B. Doe & Co.

In 1916 and 1917 the company erected a large number of industrial buildings including the Duesenberg Motor plant at Elizabeth, N. J., a grain elevator for the Harvey Grain Company of Harvey, Ill., factories for the Goodyear Metallic Rubber Shoe Company of Naugatuck, Conn., and the Henry G. Thompson & Son Company, of New Haven, Conn., a warehouse for the Summer Street Extension Trust of South Boston, a factory for the Converse Rubber Shoe Company, of Malden, buildings for the Barber Asphalt Paving Company of Maurer, N. J., and the Pawtucket Falls Bridge, in Lowell.

Early in 1918 the company became interested in the organization of the Atlantic Corporation, which was awarded a contract by the United States Shipping Board Emergency Fleet Corporation to build ten 8,800-ton steel cargo vessels at Portsmouth, N. H., at a cost of about \$19,000,000. The first ship was launched in January, 1919, and the last early the following year. The yard, representing an investment of over \$5,000,000 in land, buildings, ways and equipment, was idle until 1926, when it was sold to the Atlantic Gypsum Products Company.

In 1918 the company executed two contracts for the U. S. S. B. Emergency Fleet Corporation for the housing of shipyard workers at Portsmouth, N. H., and Groton, Conn., totalling \$3,500,000 and in 1920 it did

similar work for the Oliver Chilled Plow Works of South Bend, Ind., and C. H. Masland & Sons Company of Carlisle, Pa., these contracts involving over \$1,000,000.

The next year the company erected a large factory for the Bemis Brothers Bag Company in Brooklyn, N. Y., and subsequently has built a variety of miscellaneous structures, including a dam for the Vermont Hydro-Electric Company of Rutland, Vt., and warehouses for the Boston Elevated Railway Company in Charlestown; structures for the Rapids Furniture Company of Somerville; for the U. T. Hungerford Brass and Copper Company, for the Pacific Warehouse Trust (Great Atlantic and Pacific Tea Company, Lessees), and a number of mercantile buildings for Hon. Eugene N. Foss, the Chamberlain Garages, the Boston Ice Company, Coffin and Taber, Agents, the King Terminal, the Commercial Wharf Trust, the Boston Buick Company, the Jules DeSurmont Worsted Company, Masury Young Company, and others.

The corporate name was changed to Barrows & Co., Inc., in December, 1926. F. G. Barrows is president and treasurer; C. M. Ramsay is vice president and construction manager, and M. J. Page is secretary and office manager, all having been associated with the company since its inception. The operations at present include real estate development and financing, as well as construction. Contracts are made to include architecture and engineering in accordance with the desire of industrialists to group all elements under a single head.

F. G. Barrows is one of the trustees of the 274 Beacon Street Trust which, in 1929, was engaged in building a unique coöperative apartment house, on the site of the F. L. Higginson home, at that location, the design and layout being distinctly non-standardized and adapted to the prejudices of the buyer desirous of occupying a modern small town house without the effort involved in purchasing, alterations and upkeep.

In 1917 the E. H. Tate Mop and Cordage Company was incorporated with capital of \$10,000 and at its 67 Sudbury Street plant manufactures clothes lines, mops, spool, picture, antenna and magnet wire, employing seventy-five operatives. The factory is equipped with 300 braiding and twelve sewing machines, eighteen spoolers, as well as winders, twistors, etc.

Edward H. Tate is president and treasurer and Frank E. B. Tate, secretary.

THE BOOTHBY FIBRE CAN COMPANY

In June, 1917, Albion Boothby and Y. Marcy Edwards began the manufacture of paper cans for dry drug products, coffee, tea, etc., under the name of Eastern Paper Can & Tube Company, with capital of \$20,000. The concern rented a building at 196 Broadway, Cambridge, and at the outset confined its sales to Boston.

In September, 1920, it purchased buildings at 25 George Street, in Roxbury, containing 30,000 square feet of manufacturing space, and developed a liquid-tight paper container, which it produced under the trade mark of "Nukan." The capital was increased to \$70,000 and Mr. Boothby became the sole owner of the enterprise that year.

The container business grew to a point where the concern sold its paper can business to the Cambridge Paper Box Company of Cambridge, in August, 1925, and concentrated its activities on a new line. That

year it began the national distribution of Nukan and in November, 1929, the concern changed its name to the Boothby Fibre Can Company, and its product to "Boothby."

The officers are: president and treasurer, Albion M. Boothby; vice president, Raymond A. Bennett; clerk, Mrs. Gertrude C. Cobbett, these three constituting the board of directors.

More than 100 employees are carried on the payroll of the enterprise, which ranks as the second largest manufacturer of liquid-tight paper containers in the United States.

The Atlantic Rope & Line Company was incorporated in 1913 with capital of \$10,000, and is engaged in the manufacture of cotton rope. Richard Delaney is president, and R. H. Pierce, treasurer.

The Massachusetts Knitting Mills, incorporated in 1918, with capital of \$300,000, and at its Jamaica Plain plant manufactures men's, women's and children's full-fashioned and seamless hosiery, golf and sport hose. J. S. Gordon is president; B. D. Gordon, secretary, and A. O. Gordon, treasurer. Three hundred hands are employed.

In 1918 the J. Freedman Thread Company was incorporated, with capital of \$88,600, and manufactures cotton and mercerized thread on spools, tubes and cones. The Boston headquarters are at 125 Kingston Street. Jacob Freedman is president; A. Freedman, treasurer, and Robert Freedman, secretary.

THE LARGEST PRODUCERS OF WOMEN'S SHOES IN NEW ENGLAND

A fixed determination to succeed, persistent energy, conscientious study, concentrated and continuous thought, coupled with fortunate circumstances and good health, constitute the creed of a Russian emigrant boy who has written new history into the world of present day shoemaking in Massachusetts.

Frank Shapiro and his brother, James Shapiro, have accomplished what almost seems the impossible in the short space of a little more than ten years. Landing in America at the age of twelve, Frank Shapiro was directed to the city of Lynn, where he found a job in the A. Fisher & Son factory, and speedily learning English, he devoted his leisure hours to study.

Samuel Fisher took an interest in the boy and assisted him through high school, and later, when he graduated and showed marked ability, he was enrolled in Tufts College, where, after four years, he was graduated with a B.S. degree.

Chemistry attracted Mr. Shapiro and he located for a short time in Providence. There he met Louis Isenberg and Isador Stein, who had opened a small factory in Lynn under the name of the R. & M. Shoe Company, where baby shoes were produced.

James Shapiro, a younger brother, had come to America and had started with the May Department Stores as a shoe clerk, later becoming a buyer for the M. J. Bender Shoe Company of Cleveland, Ohio. When Frank Shapiro saw an opportunity with future possibilities he sent for his brother, who with Messrs. Isenberg and Stein formed the National Shoe Company in November, 1918, with a total capital of \$7,000.

The business grew from the start, and the company made attractively styled shoes which sold at fair prices. The factory was moved to larger quarters in Boston. Then came a demand for a shoe in a lower grade, and the company officials decided to open another factory to make shoes to retail at lower prices.

In 1924 Frank and James Shapiro, with Murray M. Rosenberg (then and now head of a large chain of retail stores), formed the Universal Shoe Company in Roxbury. From the very start the factory was a success, and it became apparent that another factory would be required, and the United-Novelty Shoe Company was opened in Lowell in 1926, with Jesse Aaronson, a college classmate of Frank Shapiro as president. The growth of this plant from a few cases per day to one of New England's large factories in four years reads like a tale from the Arabian Nights.

Again in 1926 the need of another plant presented itself. Philip Lown, who had graduated from the University of Maine and who was with Frank Shapiro at the A. Fisher & Son factory in Lynn, was placed in charge of the new plant—the Pilgrim Shoe Company of South Boston.

With four factories operating at capacity, it seemed the peak had been reached, but Frank Shapiro realized that his early years had been guided by Samuel Fisher, and that what opportunities he possessed he owed to this man, and, with the A. Fisher & Son business in the process of liquidation, the Messrs. Shapiro purchased the factory, and added this plant to the chain, making it the fifth unit, thus making the group the largest producers of women's shoes in New England, and giving it the third largest shoe production in the six northeastern states.

The Fisher plant, which had been removed from Lynn to Stoneham became the Publix Shoe Corporation, with David Berson as vice president and general manager, and Michael Selsberg as assistant general superintendent.

The present corporation—the National Shoe Company—is housed in a magnificent four-story and basement steel and cement plant, at 450 Harrison Avenue. The Universal Shoe Corporation utilizes a large four-story and basement plant, in Roxbury; the United-Novelty Shoe Company has a modern five-story factory, in Lowell, and is one of the best daylight plants of its kind in the state. The South Boston plant of the Pilgrim Shoe Company is a splendid four-story brick structure, and the Publix Shoe Corporation, of Stoneham, successor to A. Fisher & Son, formerly located in Lynn, occupies a four-story and basement building.

Murray M. Rosenberg, president of the Universal Shoe Corporation, is also the owner of the Murray M. Rosenberg chain of twenty-six stores, and is also connected with Max Dryzer, of the firm of Dryzer & Rosenberg, of New York City.

Upwards of 1,200 operatives are employed at the five plants of the Shapiro chain.

BOSTON AS A SHOE-MANUFACTURING CENTER

As a shoe-manufacturing center, Boston has been forging steadily ahead during the past ten years. Immediately following the post-war deflationary period and labor troubles in various New England shoe-pro-

ducing cities, many small and medium-sized plants moved to Boston, where better labor conditions prevailed, and while an incipient strike of lasters took place in the spring of 1929, it was ineffective in curtailing footwear production in the Hub.

At the end of 1921 there were sixty-one shoe firms doing business in Boston, and the number increased to eighty-one later in the decade, with a total production exceeding \$50,000,000 annually, and making the manufacture of boots and shoes the second largest local industry, exceeded only by printing and publishing, and constituting 8 per cent of the value of the city's manufactured products. At least 7,500 shoe workers are locally employed, to whom are paid annually \$9,500,000, while the stock and materials used cost approximately \$30,000,000 a year.

SOME PROGRESSIVE BOSTON ENTERPRISES

Donnell & Mudge, Inc., whose Boston office is at 65 South Street, now operate three tanneries in producing black kid, calf and boarded sides, tan boarded sides, ooze splits, sheep leather for linings and embossed sheep and goat leather for fancy trims.

The Crescent Tanning Company has its Boston office at 107 South Street, and its tannery and japanning factory, at Woburn, where patent leather in black and all colors and its crescent jet black products are manufactured.

The corporation has capital of \$300,000, and employs upwards of 300 operatives. B. J. Kaplan is president, and S. Feuerstein is treasurer.

The Premier Leather Company, producers of Premier kid and patent sides has its Boston headquarters at 72 South Street.

The Pendleton Wood Heel Company manufactures wood heels at its plant, at 1355 Washington Street, and numbers among its customers many of the leading Massachusetts producers of footwear.

TWO ENTERPRISES OF 1919

In 1919 Benjamin E. Maltz and David C. Sherter, with capital of \$5,000 established the Hub Floral Manufacturing Company and began the manufacture and importation of artificial flowers and memorial designs. A year later, and again in 1924 and 1928 it became necessary to make substantial additions to the company's factory at 2307 Washington Street, and at the present about 22,000 square feet of floor space are utilized. The corporation employs forty operatives.

In a Portland Street loft, in 1919, and with original capital of \$10,000, the Box Craft Company began the manufacture of high-grade paper boxes, adapted to the merchandising of candy, toilet articles, and textile goods, and the following year the corporation bought a brick plant, in Somerville, containing 15,000 square feet of floor area, and removed its equipment to that location.

In 1922 an addition to the factory was erected, and a complete printing plant for color work and leaf stamping was installed. Two years later the assets of the Atlas Box Company were purchased, and the equipment added to the Box Craft Company's facilities. The plant and machinery today represent an investment of \$200,000. The office and display room are located at 185 State Street, where sales work, designing

and other details not normally carried on in a manufacturing plant are handled.

Edgar E. Abrahams is president and treasurer, and Charles Gilmore, secretary, and they with C. Henry Lerner and Cecil Ogden constitute the board of directors.

Associated with the Box Craft Company is the Paper Goods Company, which commenced operations in 1915 as a distributing concern for a limited time of high-grade paper products, and which rendered professional service on the subject of handling and packaging large lines of merchandise, and specialized particularly in cases where proper packing would have a tendency to increase the sales. The business was so successful that the Box Craft Company was evolved to manufacture a large proportion of the boxes and other paper commodities handled by the parent company, and the latter enterprise now acts as the distributor and direct sales representative of not only the Box Craft Company but of a number of other leading paper manufacturing and producing concerns. Its tonnage now runs annually to more than 150 carloads of paper boxes alone, and a display room is maintained at 185 State Street. Edgar E. Abrahams is president and treasurer of the Paper Goods Company, which has capital of \$200,000 and employs fifty-five hands.

THE GREEN SHOE MANUFACTURING COMPANY, INC.

From a volume of business of approximately \$300,000 in 1919 and 1920 to one of \$1,250,000 in 1928 and 1929 is the story of the Green Shoe Manufacturing Company, whose general office and plant is located in a magnificent five-story modern factory at 960 Harrison Avenue, corner of Randall Street.

The growth of this concern in one short decade illustrates the fact that the promoters of this enterprise have succeeded in creating an industrial corporation that has achieved a commanding position in the shoe-producing field in this Commonwealth, despite the assertions made by the uninformed that the day of new footwear units has passed in Massachusetts.

In 1919 Jacob A. Slosberg and Phillip Green incorporated the concern, the latter retiring two years later, when Charles B. Strecker purchased a substantial interest from Mr. Green, and became an equal partner, with Mr. Slosberg. The capital stock was fixed at \$100,000 at that time, and Mr. Strecker became president and treasurer, and Jacob A. Slosberg, Seymour M. Strecker, and Samuel L. Slosberg, vice presidents.

In the original factory at 75 Northampton Street, Roxbury, the concern employed from 150 to 200 operatives and had a daily capacity of 2,000 pairs of stitch down shoes per day.

In 1924 the corporation erected its present plant, which has a capacity of approximately 4,000 pairs of shoes per day, and a line of girls', misses' and children's welts was added, which today constitutes the company's foremost product. At the inception of the business the concern sold the bulk of its products to jobbers and large volume handlers of shoes, but now practically the entire distribution goes to high-grade retail accounts throughout the United States, and with from 250 to 300 operatives the company has an annual payroll of approximately \$350,000. The Boston sales office is located in the Statler Building. The corporation has capital of \$100,000.

THE AMES SAFETY ENVELOPE COMPANY

On July 1, 1919, J. W. Fitzgerald, who for twenty years previously had been in the employ of the postal department of the United States Government, began the manufacture of the Ames Safety Envelope, with two employees on the payroll.

Today, the Ames Safety Envelope Company at its 55 Sudbury Street factory and office employs sixty men and women, and it also maintains sales offices in five of the principal cities of the United States.

Its Amestyle Products are registered in the U. S. patent office, and include flat and expanding safety mailing envelopes, expanding and flat filing wallets, expanding file pockets and adjustable webbing binding straps. J. W. Fitzgerald is president and treasurer of the corporation.

THE KEYSTONE MANUFACTURING COMPANY

In June, 1919, following the close of the World War, when the importation of German toys was at a low ebb, Edward M. Swartz, J. M. Weisman, and Benjamin Marks incorporated the Keystone Manufacturing Company and began the manufacture of the now famous line of Keystone steam shovel and truck toys. Originally occupying 2,000 square feet of area, this has grown until today more than 40,000 square feet are used in the production of metal, or so-called heavy duty toys. A volume of about \$50,000 in sales the first year has grown to \$500,000 in ten years, and the company markets its products throughout the United States, Canada, Mexico, South America, Cuba, England, Australia, and the Philippines, while competition with Germany is keen, even with the 70 per cent tariff duty.

Mr. Swartz is president, Mr. Weisman, treasurer, and Mr. Marks, vice president, and I. Marks is secretary.

The line of production has been enlarged to include not only steam shovels, with extensive arms and dump trucks, but also truck loaders, steam rollers, wrecking cars, mail trucks, U. S. army trucks, ambulances, chemical pump engines, water pump towers, fire trucks, aerial ladders, fire towers, mail planes, locomotives, freight cars, railroad wreckers, coast-guard trucks, express vans, sprinkler tanks, moving vans and police patrols.

THE BURTON-ROGERS COMPANY

The Burton-Rogers Company was organized in 1919, with capital of \$50,000, by Mason T. Rogers and Carlisle W. Burton to market automotive specialties which required technically trained men as distributors. The corporation represented the Burd High Compression Ring Company of Rockford, Ill., the Graton & Knight Company of Worcester, and the Hoyt Electrical Instrument Works of Penacook, N. H. Later the company devoted its activities exclusively to the manufacture and sale of Hoyt ammeters and voltmeters in the automotive, radio and other fields where meters are used.

These products designed for the dashboards of automobiles and for testing in battery stations and garages have become leaders throughout the country. With the progress of the electrical industry, the use of meters is becoming more and more extensive, and at the company's factory, in Penacook, N. H., 150 hands are employed.

The corporation now has capital of \$129,000. Mason T. Rogers is president, and Carlisle W. Burton, secretary and treasurer.

THE STEARNS, PERRY & SMITH COMPANY

The Stearns, Perry & Smith Company was incorporated in July, 1919, with capital of \$50,000 by M. H. Stearns, who was chosen president; J. J. M. Smith, who was elected vice president, and R. A. Perry, who was chosen treasurer, these officials having served the company since it was organized.

The enterprise deals in and repairs electric motors, generators, transformers and other electrical equipment and carries on electrical engineering and contracting.

Its first location was at 51 Chardon Street, where quarters were occupied for two years, when the growth of the business necessitated taking facilities on the street floor at the same number. Three years later the concern moved to 10 Thacher Street, where it remained until July 15, 1929, when it reoccupied the original quarters, on the street floor at 51 Chardon Street with double the floor space which it had previously.

In 1925 the corporation acquired the controlling stock and management of the Derby Electric Motors Company, the oldest and largest electrical contractors in Lowell, and it now employs upwards of thirty operatives.

THE NEW ENGLAND SPUN SILK CORPORATION

The New England Spun Silk Corporation incorporated under the laws of this Commonwealth, has become a widely known industry, with offices in the Brighton district of Boston, and in New York, and mills at Brighton, and at Newton Upper Falls.

The corporation produces high-grade spun silk yarns, which are principally used in the manufacturing of silk fabrics, such as velvets, plushes, satins (charmeuse), rapiers, tub silks, and duvetynes. Spun silk is also employed in the manufacture of knitted fabrics, sewing threads, for the insulation of electric wires, and for the decoration of worsted and woolen goods, the raw materials consisting of the waste made during the reeling process of the silk cocoons, of cocoons unfit for reeling, and from waste produced in throwing and weaving raw silks. Most of this material comes from Japan, China, Italy and the Near East.

The bulk of the company's production is shipped to the silk weaving and knitting plants in New England, New York State, New Jersey and Pennsylvania.

Both plants of the company are equipped with the most modern machinery; cover about seven and a half acres of floor space and employ over 1,000 hands. The concern has made it a policy to keep working conditions at both plants up to date.

The Newton Mills were purchased by the New England Spun Silk Corporation, from William Ryle & Co., in 1920, but have been materially enlarged since, and despite the poor conditions prevailing in the New England textile industries during the last few years, the company has been running its mills continuously on full time, assuring the operatives steady work.

The officers of the corporation are Henri Doll, president; Ivan A. Strohl, vice president, and J. P. Petitmermet, treasurer.

The manufacture of spun silk was taken up in this country around 1850, and today the spun silk industry in the United States is estimated to represent about 20 per cent of the spun silk industry of the world.

THE SHAWMUT ENGINEERING COMPANY

The Shawmut Engineering Company was founded in 1920 to succeed the American Warp Drawing Machine Company established in 1889. The latter concern had developed a machine for drawing in warps in cotton mills, and other special machinery, and had disposed of the former to others. The Shawmut unit was organized to continue the manufacture of special machinery and equipment for use in the production of axminster carpets and rugs, most of which is being operated in plants under lease. The Shawmut plant at 179-195 Freeport Street, Dorchester, consisting of brick and frame buildings has a floor area of 22,000 square feet, and the concern normally employs 150 operatives.

The founders of the Shawmut Engineering Company were the late Charles D. Lanning, and Edgar F. Hathaway, who is vice president and general manager of the corporation, which has capital of \$250,000. Edward Lanning is president and treasurer, E. F. Hathaway, vice president and general manager, and James D. Gordon, assistant treasurer and clerk.

In addition to axminster tubing machines and equipment, the concern produces automatic reed cleaning and polishing machines, novel textile appliances, special machinery, and designs and manufactures novel mechanical and electric machinery and processes.

THE JONES & HEWETT OPTICAL COMPANY, INC.

In 1920 A. D. Jones and F. H. Hewett organized the Jones & Hewett Optical Company and began the manufacture of high-grade optics for scientific instruments, at Jamaica Plain, and in June, 1929, the concern was incorporated under the laws of Massachusetts, as the Jones & Hewett Optical Company, Inc., and removed to a new plant on Clarendon Avenue, North Cambridge.

It now produces lenses, prisms and parallel mirrors as well as optics and glass work for the makers of scientific instruments. A. D. Jones is manager, and upwards of fifty hands are employed.

THE SPLENDOR MACARONI COMPANY, INC.

The Splendor Macaroni Company was incorporated in November, 1921, with the following officers: president, Max Francesconi; treasurer and clerk, John N. Marinoni. In January, 1923 the present officers were elected: John N. Marinoni, president and treasurer; Theodore R. Molinari, assistant treasurer, and Louis J. Isola, clerk.

The predecessor of this concern was the Aeolian Macaroni Company, and the first manager of the new corporation was Felix Vergona, formerly connected with the Aeolian Company. Since July, 1923, Theodore R. Molinari has been general manager. He entered the business in 1922, and probably is the youngest to hold managerial reins in this new industry.

The plant and main office are located at 540 Sumner Street, East Boston, where all types of alimentary pastes are manufactured from pure durum wheat semolina. The uses of all artificial coloring, or other in-

gredients which misrepresented the commodity were forbidden even before prohibitive legislation was passed by many states, and frowned upon by some of the U. S. Departments.

The company's products are marketed under several brands, the best known of which are the Splendor, Pasco, La Napoletana, Aeolian, Faro di Messina, and Lira. Its center of distribution is New England, although some of its production is shipped to upper New York State. The concern is known as a New England organization, catering to New England trade. It carries on distribution through jobbers, and direct to retailers and chain stores.

Since its organization the plant capacity has been increased 300 per cent. The Splendor Macaroni Company is closely affiliated with the P. Pastene Company, of Boston, the largest manufacturers and importers of Italian olive oil, cheese, tomatoes, tomato paste and other products, and derives the benefit of over fifty years' experience in this trade. The company is capitalized for \$100,000, and employs from forty to sixty operatives, depending on seasonal fluctuations.

It owns 42,000 square feet of land area, and the main building and two additions occupied by it were formerly used by the General Electric Company.

THE BLUE DIAMOND MATERIALS COMPANY

About fifteen or eighteen years ago William C. Hay of Los Angeles, Calif., erected a plant for the production and delivery of machine-mixed brick mortar and lime plaster delivered ready for use. Securing process patents, the system met with such success in economy, speed and convenience that other plants were licensed and built. The Blue Diamond Materials Company was formed in 1921 and the first Massachusetts plant was erected at West Roxbury, to serve the south side and Boston proper, and later a second plant was built at Malden, which serves the north side and Boston.

The material and service have been used on such structures as the Park Square Building, the Statler Hotel, the Motor Mart, the First National Bank Building, the Chamber of Commerce Building, the Atlantic National Bank, the Hotel Bellevue, the Insurance Exchange, Thompson's Spa, the Decatur, Hopkins Building, the Pettingell-Andrews Building, the Congress Building, the United Shoe Corporation Building, the Employers' Liability Building, the Dorchester High School and many others, public and private.

There are now seventeen plants throughout the country operating under the Blue Diamond trade name.

W. H. Hastings is treasurer of the corporation.

THE SPECIAL TOOL AND MACHINE COMPANY

In February, 1922, Edwin A. Bye, Carl J. Wennberg and Bengt A. Svenson established the Special Tool and Machine Company at 410 Dorchester Avenue. At present the concern is engaged in producing Bakelite and hard rubber moulds, and also carries on general machine work.

In March, 1922, the company was incorporated, with capital of \$30,000, and in June, 1923, Mr. Bye sold his interests, at which time the capital was reduced to \$20,000. The present owners are Messrs. Wennberg and Svenson.

In 1924 the plant was moved to 23 Power House Street, South Boston, where 4,800 square feet of space were occupied, which was increased in May, 1929, to 6,000 square feet. Twenty-five hands are employed.

THE ROXBURY STEEL CASTING COMPANY

In eight years the Roxbury Steel Casting Company has developed into an enterprise that occupies a site at 53 Gerard Street, in the Roxbury District, of approximately two acres, and employs 125 men in producing a general line of open-hearth steel castings, ranging from a pound to 30,000 pounds in weight, and supplying the machine tool, marine and railroad industries.

It is the only concern of its kind in New England operating open-hearth furnaces exclusively for the general consuming trade, and was organized in September, 1921. The corporation has capital of \$100,000 and I. E. Sexton is president, and P. C. Rogers, treasurer and general manager.

Frederick A. Cheney is manager of the Northeastern Sales Department of the Yates-American Machine Company which was created on October 1, 1925, when a merger of the P. B. Yates Machine Company, with the American Woodworking Machinery Company of Rochester, N. Y., was effected, which resulted in the largest single woodworking machinery producing organization in the world. The Boston headquarters are at 120 High Street, and in addition to the Yates-American products the concern is the exclusive sales agents for Baxter D. Whitney & Son, Inc., of Winchendon, and the Jenkins Machine Company.

THE MIDDLESEX PRODUCTS COMPANY

The operations of the Middlesex Products Company, which was established in 1923, are conducted by the Reversible Collar Company, incorporated in 1866 by George K. Snow, George N. March, Phineas Pierce and S. S. Gray. The plant is located at 111 Putnam Avenue, Cambridge, and contains about 100,000 square feet of floor space.

The Middlesex Products Company is engaged in the manufacture of glazed, plated, embossed and cloth-lined papers, the glazed and embossed types being used mainly for the covering of boxes, while the plated or dull-finished papers are employed in preparing labels and for printing in general.

The cloth-lined paper is used for maps, wall charts, large envelopes, pamphlet covers, clothing tickets, tags, and a variety of purposes where something stronger than ordinary paper is required.

Elwell R. Butterworth, son of the late Robert Butterworth, who was with the parent company for over fifty years, is superintendent, and George H. Riker is assistant superintendent of the plant.

The parent company, in addition to conducting the business of the Middlesex Products Company, manufactures Linene collars and kindred products. Walter B. Snow is president, and William G. Snow, treasurer, both being sons of the late George K. Snow, one of the founders. The main office is at 38 Chauncy Street, Boston.

The Sherer Knitting Mills were established in 1923 by L. and A. J. Sherer and produce bathing suits, athletic and sport wear goods, golf vests and theatrical goods.

In 1924 the Partlow Garnetting Company was incorporated with capital of \$100,000 and employs twenty-five operatives in carrying on custom garnetting. A. E. Partlow is president and treasurer.

In 1924 J. C. Pushee & Sons, Inc., was incorporated and is engaged in the manufacture of paint brushes. The corporation employs 450 operatives. George D. Pushee is president and A. W. Church treasurer and general manager.

THE ENGLANDER SPRING BED COMPANY

Since 1895 the Englander Spring Bed Company has served the American people with its beds and bedding, but it was not until 1924 that the New England demand for its products became so great as to warrant the operation of a completely equipped production plant, in Boston, which today supplies the six northeastern states. Shortly afterwards, it was deemed desirable to open a permanent show-room in Boston. The company also maintains plants in Brooklyn and Chicago, and show-rooms in New York and Chicago.

In manufacturing Englander merchandise, each operation, from the time the iron or steel is delivered to the plants until the finished bed is placed on a truck or in a freight car, or shipped for delivery, is completed at the factories. There the flat strips of steel are cut, bent, punched and put into place, the springs are made, the frames painted by hand, dipped or coated with the aid of an air brush and the mattresses are sewed and stuffed with cotton, taken from bales shipped directly from the South to the three plants.

All three factories are served by the company's own side tracks, thus saving double loadings and expediting deliveries.

Seasonal demands do not naturally affect the company and the three plants keep up a steady production, week in and week out. Camp beds, canvas cots and couch hammocks show some seasonal tendencies naturally, but when it is cold in one part of the world it is hot in another and as the Englander concern is now an international supplier of sleeping equipment it is practically unaffected by the changing seasons.

The Boston show-rooms are located in the American Furniture Mart, at 88-90 Canal Street, and the Boston factory is at 1591-1619 Hyde Park Avenue. The corporation has capital of \$5,000,000, and employs 200 operatives. Max Englander is president, Benjamin B. Englander, vice president and treasurer, and Gene Herz, Emil A. Kann, Louis L. Bush, Ernest Cohen and Peter P. Bebry, are vice presidents.

THE HOWARD W. HILL COMPANY

The Howard W. Hill Company, incorporated in 1924, is an outgrowth of P. A. Field Shoe Company, which was originally organized in 1899, and which until 1913 was located in Salem. In the great fire of that year, the factory was completely destroyed, but before the ruins were cold, the management had secured a location in Beverly and had ordered complete new equipment. Within two months thereafter shipments of shoes were going forward to customers all over the Eastern and Middle Western sections of the country. It was at that time that Howard W. Hill became associated with the enterprise, having previously been connected

with the Austin-Perry Company of Haverhill, as its vice president and sales manager.

In 1924, on the retirement of Mr. Field, a new company was organized by Mr. Hill to take over the plant and the business. With some readjustments, the organization continued as before and due probably to the fact that Mr. Hill had been known to most of the customers as sales manager, the present corporation was able to secure all the customers of the predecessor company.

The company's product is women's shoes which are sold at a medium price to the retail trade under the name of Beverly Hill Vanities and to the wholesalers under the name of Insolite. The officers are: Howard W. Hill, president and treasurer; Warren L. Delaney, vice president and assistant treasurer, and Mary A. Woodbery, clerk. The corporation has capital of \$60,000, and employs 200 operatives.

In 1925 the Glenwood Tinsel Manufacturing Company was established by I. H. Monahan to manufacture tinsel ribbons and cords.

THE ATLAS PLYWOOD CORPORATION

Another outstanding Massachusetts industrial development of the last five years that belies the oft-repeated statement that this section is experiencing hardening of the manufacturing arteries, is observed in the formation, in July, 1925, of the Atlas Plywood Corporation, which that year acquired all the properties of Nelson & Hall Company, founded in 1889, the Veneer Products Company, the Allen Quinby Company, the Standard Seating Company and a Vermont unit, which then did business under the name of the Atlas Plywood Corporation, and evolved a complete manufacturing concern for the economical production of and sale of plywood and veneers. Instantly it took rank as the largest manufacturer in the United States of plywood and plywood boxes, and entered upon the production of furniture veneer, lumber, butter tubs, and chair seats.

Its original holdings included 32,000 acres of timber lands, estimated to contain more than 83,000,000 feet of hardwoods and spruce, of an appraised value of \$600,500, and five manufacturing plants in Vermont and Maine, with two assembling plants in Lawrence, in this state, and in Camden, N. J., which, with their equipment and real estate, possessed an appraised value of \$2,401,751, and having, as of December 31, 1924, current assets of \$1,397,721, as against current liabilities of \$318,639.

On June 30, 1928, the corporation possessed total assets valued at \$6,243,981.42, current assets of \$1,722,871.32 and its plant properties and equipment, less depreciation, were valued at \$2,989,280.73, and its timberlands, less depreciation had a value of \$1,438,811.82. The company had capital stock of \$3,061,469.94, capital surplus of \$5,409.04, earned surplus of \$22,459.15 and a net worth of \$3,291,474.13, as of that date.

C. T. Hall, one of the founders of the Nelson & Hall Company, became chairman of the board of directors and Ralph M. Buck, then vice president of the Nelson & Hall Company (the largest of the constituent units), became president and general manager of the new corporation.

Since 1925 the business and assets of the Empire Manufacturing Company of Goldsboro, N. C., have been acquired by the Atlas Corporation, and as manufacturing is carried on at this unit, the Boston concern is in a strategic position to extend its rapidly growing business throughout the South. The corporation now owns approximately 265,801,000 feet

of standing hard and soft wood timber in New England, North Carolina, and Canada, and additional timber is being acquired constantly through purchase of stumpage rights.

Under the able management of President Buck assembling plants have been established during the past five years in Bloomington, Ind., Jamestown, N. Y., Grand Rapids, Mich., Passaic, N. J., Phillipsdale, R. I., and in Southbridge, North Adams, New Bedford, and Lowell, in this state, which, with the original Lawrence and Camden units, gives the corporation eleven auxiliary plants, as well as six producing factories, in which upwards of 1,500 operatives are employed.

E. I. MacPhie, vice president in charge of sales, was for eleven years president of Otis Allen & Son Company, box manufacturers of Lowell, now a wholly owned subsidiary of Atlas Plywood Corporation. The company's main office is located at 934 Park Square Building, Boston. The company now ranks as the largest manufacturer of plywood packing cases in the world, and in 1928 sold its product in every state east of the Mississippi.

It has expanded recently in the textile, refrigerator, radio and phonograph, furniture and paper industries, and is diversifying its outlets. The productive capacity of all its factories is 2,500,000 square feet of plywood a week, and the capacity of its combined assembling plant is 750,000 square feet a week. The aggregate timber reserves of the combined properties in 1928, were approximately 300,000,000 board feet. Hardwood of the cheaper grades used for this purpose can be bought readily, and there is no possibility of exhausting the supply for years to come.

Plywood packing cases are now used to ship 149 different commodities, and can be used for almost any kind of finished merchandise advantageously. They permit savings in freight, eliminate pilfering, dust and water damage, reduce damage from case markings on highly finished merchandise and afford valuable advertising space, as the panels can be printed.

The recent opening of a Canadian plant gives the company an advantageous position in that country and afforded it new potential territory. The company received, in 1928, the largest order for plywood cases ever placed in the United States, and one which covered the entire packing requirements of Showers Brothers Company, the largest manufacturers of furniture in this country. The shipment of furniture in plywood packing cases opened a big field of expansion for the Atlas corporation, within whose actual selling area over 88 per cent of the furniture making capacity is located. The same year it also booked an order for packing cases from one of the largest manufacturers of explosives in the United States, which represented a sufficient volume of new business to operate two of its recently acquired plants, at capacity, for a six months' period and which represented 5 per cent of the corporation's entire orders in 1927.

In 1929 an idle clothespin mill, in Stockholm, Me., acquired as part of a merger, in 1925, was equipped to produce veneer panels used in furniture and panel work. In the vicinity of Stockholm is harvested some of the finest birch obtained in North America. Ralph M. Buck is president; E. J. MacPhie, vice president and treasurer, and A. H. Edgerton, vice president. Thirteen hundred hands are employed.

THE FILING EQUIPMENT BUREAU, INC.

The history of the Filing Equipment Bureau, Inc., is not only vividly interesting and romantic, but it provides added evidence that Massachusetts men of ideas, initiative and ability still carry on along the lines of the best traditions of this section of the nation.

In March, 1926, C. H. Cobb and R. H. Charlton sensing the need of an institution involving the production of the highest quality of filing equipment and supplies, plus a personal service which would enable users of these commodities to realize the maximum value and efficiency of their investment formed the corporation and capitalized their industrial background of many years.

The founders were peculiarly fitted to inaugurate and conduct such an enterprise, as both had contributed, over a long period, to the up-building of the Library Bureau, which corporation had maintained for many years undisputed leadership in its peculiar field.

Mr. Cobb had been the financial vice president of that corporation, which office he resigned to form the Filing Equipment Bureau, Inc. In the quarter of a century that he has associated with the Library Bureau he had served, first as a salesman, next in charge of service and production, then as treasurer of the London, England, corporation, which he opened, and where he was located for five years, and finally, upon returning to the United States he was placed in charge of financing the parent corporation.

Mr. Charlton became identified with the Library Bureau in 1913, and served as chief of the purchasing department until his resignation in 1926, when he controlled the purchasing of all departments and branches, and where his natural aptitude for quality greatly contributed to the high standards of that company's products and policies.

The Filing Equipment Bureau, Inc., immediately purchased the Boston Index Card Company, which had been operating successfully as a card index and filing supply concern for many years, and with its assets came a modern and well-equipped plant which it had built, and which, at the outset, it was believed would serve the needs of the new company for some years to come.

The new corporation developed a large sales department, and opened branch offices in Portland, Manchester, Springfield, Providence, Hartford, New York City, and Newark. New products were added almost daily, many of them being decided improvements over the items that were replaced, and a large number being exclusive developments. The company now manufactures the most comprehensive line of filing supplies in the world, and has introduced more practical improvements and innovations than have been produced by other concerns in similar lines during the past decade.

In 1929 a dealer division was formed, which has shown phenomenal progress, and as a result of the rapid growth of the concern the original plant was found inadequate, and in September, 1928, less than three years after the company was formed, a new factory was acquired containing double the area of manufacturing space afforded in the original plant. The company occupies upwards of 60,000 square feet of space in a six-story building at 27 Melcher Street, and employs upwards of 150 operatives. Using the sales of the Boston Index Card Company

for the year before its assets were acquired by the Filing Equipment Bureau, Inc., as a yardstick, the new company has increased the volume by 400 per cent in a three-year period, and it now has capital of \$300,000.

It conducts its business on the principles that have made New England famous throughout the world as a manufacturing center—the best that can be made, and sold at a fair profit. After three years of preliminary development, the company's executives feel that the concern has just begun to grow.

C. H. Cobb is president; A. B. Price, secretary, and R. H. Charlton, treasurer of the corporation.

THE BOSTON SPECIALTY CASE COMPANY

In November, 1927, the Boston Specialty Case Company was incorporated, with capital of \$50,000, succeeding the Brooks Manufacturing Company, which had been engaged in the manufacture of jewelry boxes.

The new concern has made a specialty of designing and producing special displays of wood or cardboard that will aid manufacturers in marketing their commodities, and the company now utilizes the services of sixty operatives and occupies 10,000 square feet of area.

Jewelry, silverware, display, and technical cases, trays and pads, and advertising devices constitute the bulk of the company's output. A. H. Vegkley is manager of the corporation. H. L. Chenery is president, and M. F. McFarland, treasurer, and sixty hands are employed.

THE BROCKWAY-SMITH-HAIGH-LOVELL COMPANY

The Brockway-Smith-Haigh-Lovell Company, whose main office and warehouse are located at 465 Medford Street, in the Charlestown district, was organized in January, 1928, as the result of a merger of three long established and successful firms in the same line of business—namely, the Brockway-Smith Corporation, the Jackson & Newton Company, and the Lovell & Hall Company. The new company is among the largest jobbers of doors, windows, window frames, and building material of similar nature, in the United States, if not actually the largest.

The Brockway-Smith Corporation began business in Lynn in 1890, the year following the big fire in that city. The main office was moved to Boston in 1906, where it was located at 18 Washington Street North, and later at 98 Canal Street. In 1924 the headquarters were moved to 465 Medford Street, where the warehouse had been previously established and where the company occupied a newly erected, modern five-story concrete building the lower floors of which were used for manufacturing purposes. C. Fred Smith, former president of the Brockway-Smith Corporation, is president of the Brockway-Smith-Haigh-Lovell Company.

The Jackson & Newton Company started in business in 1903, and until a few years ago was located in Haymarket Square, finally moving to Medford, where the concern remained until the merger took place. James R. Haigh, who was originally with this company, is treasurer of the Brockway-Smith-Haigh-Lovell Company.

The Lovell & Hall Company began business in 1909, on Portland Street, and moved several years ago to North Cambridge to a plant erected for its occupancy, and where the headquarters remained until the concern became a part of the Brockway-Smith-Haigh-Lovell Com-

pany. Howard B. Lovell is one of the vice presidents of the Brockway-Smith-Haigh-Lovell Company.

The other officers of the new corporation are Edwin W. Tibbetts, vice president and clerk; John H. Osborn, vice president, and Howard C. Smith, assistant treasurer, all of whom were previously connected with the Brockway-Smith Corporation.

The Brockway-Smith-Haigh-Lovell Company is capitalized for \$1,000,000, occupies about 200,000 square feet of floor space in Charlestown, and employs about 250 operatives. It has an unusually complete plant, including a cafeteria of its own on the premises, and operates branches in Lynn, Portland, and New Haven, and a selling office in Boston.

AUTO-HYDRO-CRAFT, INC.

A new and revolutionary step was taken in 1929 in the long march of man's progress from the distant past to the scientific, mechanical and cultural supremacy of the modern day, and in recognition of his craving for speed, beauty, efficiency and pleasure.

Like all great strides that have preceded it, this new effort was created by the foresight and imagination of one man, who, peering into the future, surmounted every obstacle to present the product of his vision to the world.

Connected for many years with the automobile body industry, in Detroit, Kenneth L. Childs determined to automobilize the modern motor crafts and to apply the manufacturing methods, mass production, construction, designing and engineering that had flowed from the discoveries and the experiences in the automobile field to the motorboat industry, whose growth during the past two or three years has been comparable to that of the automotive and radio trades.

Mr. Childs reached the conclusion that quantity buying, quantity production and standardization, would make possible drastic price reductions, thereby effecting a tremendous increase in distribution, and his work reached its fruition with the organization of Auto-Hydro-Craft, Inc., in April, 1929, a corporation composed entirely of New England men of the highest reputation and financial standing.

He believed that the automobile is ceasing, more and more each day, to be a source of pleasure, and that traffic congestion is transforming it into a vehicle for passenger transportation rather than mere touring, and that the public of tomorrow will take to the broad blue expanse of the country's bays and rivers and lakes for the fulfillment of its pleasure. The public has been educated to the beauty, the luxury, the efficiency and the speed of the automobile, and in a motorboat which inculcates all of the striking color effects and design of the modern automobile's artistic eye-appeal rests the future of the motorboat industry. It is now passing through the stage which the automobile industry entered twenty years ago. Autos were then made by old-time carriage-makers, and built of wood. To fabricate them of steel and aluminum was considered "a crazy idea."

Today the old carriage-builders are out of business. Still orthodox and old-fashioned in the main, the motorboat industry of today is in a correspondingly backward stage of evolution and clings to boats constructed of wood.

Immense savings in production cost are being achieved in building

automobile bodies by means of die-stamped metal panels and reinforced frame construction as against the former wooden-veneer type.

Auto-Hydro-Craft, Inc., arranged with the Biddle & Smart Company of Amesbury to manufacture boats exclusively for it, in addition to the automobile body business carried on at the Essex county plant, and eight different models, three 16 feet in length, three 18-footers, and two of 22 feet in length, painted in lacquer finishes, with speeds of from 25 to 35 miles an hour, forward air-compartments, making the craft non-sinkable, fireproof and water-tight hulls, were placed on the market, in 1929.

After a complete survey of the boat industry, its manufacturing, distribution and sales problems, President Childs chose Massachusetts as superior to any other section of the country for these reasons:

First—Because the source of supply was nearest to the company's largest potential market.

Second—Because connection could be had with the Biddle & Smart Company, a concern fully versed in all angles of mass production and maintaining the very highest grade of workmanship; and where efficient executive ability made possible quantity production at a cost in keeping with the supposedly cheaper methods of the Middle West.

Third—Because the shipping facilities of New England are more suited to the distribution of Auto-Hydro-Craft, Inc., products than any other section of the country, and because tidewater shipments from the source of supply to Southern waters to the West Coast, and for the handling of export business were better here than elsewhere.

Fourth—Because a complete network of excellent roads reaches every body of inland water, bay and river, making overland delivery possible whenever advisable.

Fifth—Because it was President Childs' personal desire to return to this section of the country where, within a reasonable length of time, one can enjoy the full beauties of nature. He learned that much of the talked-about hustle and bustle of the Middle West accomplishes little compared to the efficiency to be found in New England organizations where much more is done and much less said.

The company maintains its Boston headquarters at 100 Arlington Street.

SOME BOSTON PUBLISHING FIRMS

Hale, Cushman & Flint of 857 Boylston Street is one of the younger Boston book publishing houses. Its president, Ralph T. Hale, long treasurer of the Boston Authors' Club, has been for many years the publisher of the Medici prints and cards, and that business has been taken over by the new firm.

Charles E. Lauriat & Co., 385 Washington Street, does not confine itself to bookselling, in which it has long been a leader in the Boston field, but occasionally becomes a publishing house, especially when Mr. Lauriat finds a book about the sea, ships or sailors which he desires to introduce to American readers.

The Lothrop, Lee & Shepard Company of 275 Congress Street, of which Warren F. Gregory has been the head for a full quarter century, specializes in publishing books for young readers—though it occasionally issues one outside that field—and it is probably safe to assert that no

publishing house in America has been known longer or more favorably in this particular line.

THE FLINTKOTE COMPANY

In the story of the Flintkote Company is found another outstanding and shining example of successful Massachusetts enterprise, and although the corporation has experienced a growth in sales and earnings during the five-year period between 1923 and 1927 that is the envy of many concerns, during which time the sales figures rose from \$6,717,921, in the former year, to \$14,061,868, in 1927, these are rapidly piling into insignificance, as the 1928 sales reached the imposing total of \$19,000,000, or more than twice those of 1926.

The history of Flintkote may be said to be the story of the asphalt roofing industry. From its inception the company was active in the field of research, striving by experiments to improve old products, to discover new uses for them, to develop new methods for producing asphalt and allied commodities. The company's present volume flows from seven asphalt roofing factories, each supplied by the necessary felt mills and asphalt blowing plants, each normal business day providing sixty carloads of products.

Flintkote owns some 800 patents and patent applications covering processes, products and machinery, under many of which it licenses the industry to manufacture and sell various types of asphalt shingles, asphalt emulsions and other products resulting from the use of these emulsions. Despite the fact that the sales of emulsified asphalt products by Flintkote increased 116 per cent in 1927 over the previous year, it is believed that the surface of distribution has been but faintly scratched, and that the use of these commodities today is in its initial stages.

Flintkote has been brought into close affiliation with many important enterprises such as the Anaconda Copper Mining Company, which contact has resulted in the manufacture of "copperclad shingles," whereby these products are copperplated by an electrolytic process. E. I. Du Pont de Nemours Company is operating as a licensee of the Flintkote Company in the distribution of asphalt emulsions for use as a protective coating in the oil pipe line field, as well as elsewhere. Flintkote is the owner of important and basic patents pertaining to the emulsification of rubber, and it was the achievements of the company's research department in developing emulsions that first attracted the attention of the Royal Dutch-Shell group, which was working along similar lines.

The acquirement, in 1928, of the Beckman-Dawson Roofing Company of Chicago, a long-established business, which has grown rapidly in recent years, and which itself took over, about three years ago the Peck Asphalt Shingle Company of Detroit, Mich., and the Lockport Paper Company of Lockport, N. Y., gave Flintkote three new roofing mills and a felt plant, in addition to its previous production facilities, and with the Royal Dutch-Shell arrangement expanded the Flintkote assets from \$8,000,000 to approximately \$17,000,000. Plans are under consideration for the acquisition and construction of their manufacturing units in the Middle West and in July, 1929, the Atlanta, Ga., plant of the Pogan-Long Company of Chicago, manufacturers of asphalt shingles, was acquired.

In 1928 the Flintkote Company entered into a partnership arrange-

ment with the Royal Dutch-Shell group, of London, by which Flintkote, while retaining its own identity, management and policy, became an important member of this international concern.

The Royal Dutch-Shell interests have put into Flintkote between \$8,000,000 and \$9,000,000 additional capital. Other financial arrangements brought Flintkote's capitalization to approximately \$19,000,000, or more than double its capital prior to negotiations with the Royal Dutch-Shell group. The partnership was effected by the purchase by the Royal Dutch-Shell unit of common stock of Flintkote. An existing issue of \$2,500,000 7% cumulative convertible preferred stock was retired leaving the company with no bonded debt and ample cash resources represented by common stock.

The new capital is being used to expand the already firmly established roofing and asphalt emulsion business in America and also in foreign fields.

In this connection, Flintkote, Ltd., a wholly owned subsidiary, has been incorporated in London for the purpose of handling the development of the company's business in foreign fields.

The partnership holds great promise for Flintkote. The joining of patents by the two companies turns over to the American concern, for exclusive exploitation throughout the world, valuable patents and processes now held by the Royal Dutch-Shell group. It also gave the Flintkote Company the coöperation of a large research department specializing in raw materials which are basic to the Flintkote products, as well as assurance to the Boston corporation that its principal raw materials, particularly asphalts and other petroleum products can be acquired on a most favorable basis.

In 1929 Flintkote formed two subsidiaries, known in the United States as Flintkote Roads, Inc., and in Canada as Flintkote Roads, Ltd. These new units immediately engaged in the manufacture and distribution of asphalt road emulsions which previously had not been employed to any great degree in this country but have had a very wide and successful use in Europe. This new activity of Flintkote is a part of the plan of expansion involving the use of asphalt emulsions in road building and maintenance, supplementing the already extensive operations of the company on emulsions for industrial and commercial uses.

The corporation employs upwards of 1,000 operatives. Chester E. Rahr is president; Otto A. Heppes, Frank H. Gilchrist, Henry C. Avery, Lester Kirschbraun and William A. Harris are vice presidents; Reginald W. Bird is chairman of the board, Ronald Jones, treasurer, and W. J. Smith, clerk of the corporation.

At the end of 1928 the company was operating eight roofing factories, equipped with seventeen roofing machines and four felt mills, the latter producing 78,000 tons of products. It then controlled over 900 patents and applications in roofing, emulsified asphalt and various other fields.

Early in 1929 the Flintkote Company acquired a controlling interest in Colas, a corporation which had been operating successfully for five years over practically the entire world, with the exception of the United States. A company under the name of Colas-Flintkote, Ltd., was formed in London to acquire the various Colas units then engaged in road work, and in this country Flintkote Roads, Inc., was formed to manufacture and develop Colas in the United States, Canada and Mexico.

The Flintkote Company now has an investment of \$1,500,000 in Colas, and the prospects in 1930, with nine or ten additional plants created, are considered excellent. There will be in February, 1930, thirty-nine Colas factories in this country, Europe, Asia, the East and West Indies, and plans are under way for the erection of plants by Flintkote, or its licensees, in Los Angeles and Martinez, California, New Orleans, Chicago and Montreal. During 1929 upwards of 30,000,000 gallons of Colas were used in foreign countries, and over 1,000,000 gallons in the United States and Canada. The Colas method renders asphalt non-adhesive and the product can be installed when cold, thereby making it especially desirable in road building.

THE DORCHESTER POTTERY WORKS

Modest on its exterior, and unostentatious save for one large sign, there is tucked away on Victory Road, in Dorchester, a little manufacturing concern known as the Dorchester Pottery Works, owned by George Henderson, a devotee of clay working almost since he began life as an apprentice, in Londonderry, Ireland. Here he set up the huge kiln, a mass of brick walls four feet thick for three feet from its base, with nine fire holes almost hermetically sealed when the kiln is ablaze, and with the entrance door so tightly closed that the intense heat penetrating from the coal fires, through a radiation system within is only restrained from completely wrecking the vault, twenty-six feet in diameter, by means of giant steel straps, each six or more inches wide, which are caught by a giant turn buckle, and with the roof of the oven ingeniously made of bricks in arch effect, rising and falling like the bed of a volcano, but without crumbling or breaking open.

Within its capacious area two car loads of pottery, worth from \$1,500 to \$2,000 are placed—a collection which requires two days to install, another two days to heat, and six days to cool, while the layers of fire brick blocking the entrance are removed a row at a time.

As one wends his way through the pottery he sees mazes of racks, bearing on their shelves burdens of pots of every conceivable shape,—plain pots for Boston baked beans, crocks, jugs, urns up to beautiful garden fountains and bird baskets, and glamorously shaped vases and bulb pans.

But more interesting than these revelations are Mr. Henderson and William Hallberg, a Scandinavian, both artists and pottery makers by temperament and profession, bending all day long over their little flying discs, surrounded by other employees engaged in different phases of production. Fascinating indeed is the process as they seize a vast clump of clay, and weigh it on the scales, slap it down on the steel disc, and observe it creep upward under the tender nursing of their adept fingers, turning swiftly until like gray magic it resolves itself into a bit of something that excites wonder, and then you marvel over it as it rises with a slender neck, and a little indentation for a mouth, and then the completed urn is flung down beside a half dozen replicas, with a quick flip of a shingle-like paddle, to await its entrance into the kiln.

All day long these veritable dreams in clay come true, and these expert potters shape magic in ceramics, producing sizes and combinations so pleasing to the eye that they find a ready sale in the commercial marts of the world. These wonder workers in clay are veritable anomalies in

this heroic industrial epoch, and here romance and picturesqueness gather leaving no room for the prosaic factors of machine production.

KELVIN & WILFRID O. WHITE COMPANY

From the earliest Colonial times, Boston has been noted for its activities in the marine field, and the Kelvin & Wilfrid O. White Company of 112 State Street, is today maintaining the record of the Hub in this respect, being the only nautical instrument concern that designs, manufactures and markets its own instruments to the marine world.

The company's equipment, which comprises all the latest ideas and innovations in navigational practice, is to be found on all first class vessels from 21-footers to the largest passenger-carrying vessels afloat, the practical experience of its staff, which includes three full-fledged master mariners of world-wide experience, enabling it to appreciate the requirements of marine navigation.

Mr. White installed on the *Leviathan* the first radio compass, or direction finder, sold to the North Atlantic passenger steamers. He was also instrumental in making ship-owners realize the value of this wonderful instrument, so that it is now universally used in most passenger vessels, and was the medium through which the crew of the *Florida* was rescued in mid-ocean.

Its value is appreciated so much today that even colliers running between Norfolk and Boston have been fitted with these instruments by the Kelvin-White Company. The corporation has capital of \$100,000. Wilfrid O. White is president, G. Philip Wardner, secretary, and George Q. Hill, treasurer.

THE TERMINAL WHARF COMPANY AND THE WIGGIN TERMINALS

Boston is meeting the demands of the present and immediate future by providing modern service facilities for its industrial and commercial needs.

The development by the Terminal Wharf & Railroad Warehouse Company, at an initial cost of \$2,000,000 of a modern lumber terminal on land along the Mystic River, between Dewey Beach and the plant of the Revere Sugar Refinery in Boston, permitting of five steamship berths, five acres of macadamized streets, the installation of giant power cranes, and the laying of several miles of railroad track on the twenty acres occupied, has resulted not only in the better and more economical distribution of the vast lumber resources and lumber products coming from the West Coast and from Finland, to the Boston seaboard, but at the same time has aided in encouraging industries to locate plants adjacent to this project.

The Wiggins Terminals, Inc., is providing ultra-modern dock facilities for unloading and reshipping in the Charlestown district, in Boston, the head structures of steel and corrugated asbestos, sixty feet in height, embodying many new features of construction and furnishing another concrete example of investors who have faith in the future industrial growth of Massachusetts. The reclaiming of approximately 750 acres of East Boston marsh land from the ravages of the sea is going steadily on in the area skirting Breed's Hill, along the shores of Chelsea Creek and Bell Isle Inlet, where, a little more than a decade ago, the onlooker viewed a

panorama of slimy mud, eel grass and stagnant water, which furnished a way station for migrating duck. More than 175 acres have already been filled in and reclaimed to an average depth of twelve feet, by the East Boston company during the past fifteen years; and, with the increased facilities which include a receiving depot, a traveling crane and a steam railway to distribute the loads of filling, it is but a question of time before there will rise on this great morass, once the location of clam beds and tidal flows, an industrial city which eventually will occupy the full 1,500 available acres. Its climatic advantages for the production of fine textile goods is only rivalled by New Bedford, as the moist atmospheric element is one of its great assets.

THE THOMPSON & NORRIS COMPANY OF MASSACHUSETTS

The merger a few years ago of The Thompson & Norris Company of Massachusetts, with the Hinde & Dauch Paper Company of Sandusky, Ohio, brought into Massachusetts a unit whose ramifications are spread over a large part of the United States and Canada.

At the Allston plant of the Thompson & Norris Company upwards of \$1,500,000 worth of corrugated boxes and paper products are turned out each year, and more than 200 operatives are employed.

J. L. Thompson is president, W. G. Chapin, secretary, and Martin H. Day, treasurer and vice president.

THE ICE CREAM INDUSTRY

The wholesale ice cream industry is, in point of age, one of the infants of American business when compared with many other lines of manufacturing activity, but it is a lusty octogenarian that has undergone an amazing gland operation during the recent years, and one that was inspired by the changing dietary habits of the American people and to the successful efforts of wholesale manufacturers to turn out a pure and nutritive product.

New England has shared in the expansion of the industry, it being estimated that the group of states comprising the northeast portion of the United States, with 6.93 per cent. of the total population, has produced 6.96 per cent. of the ice cream made in the wholesale manufacturing plants of the country.

Despite the apparent youth of the ice cream industry, its origins reach back into one of the most colorful periods of the nation's history, and Massachusetts contributed to the development as early as 1786 when ice was cut on Lake Wenham in the town of Wenham, and shipped to New York for use in the manufacture of ice cream. The growth of the industry was slow and, in some cases, painful. Experience proved costly and in the early days it had to build its own methods and devise its own equipment as it developed.

So far as is known, the manufacture of ice cream for sale through dealers, instead of directly to consumers, was begun in 1851 by Jacob Fussell, then a milk dealer in Baltimore. In 1856, his success led him to open a second plant in Washington and six years later he established a third in Boston and a fourth in 1864 in New York.

To this enterprising progenitor of the ice cream industry must be credited, in addition to his eastern successes, the genesis of the industry in the West, for it was an employee who gained his first lessons in ice

cream manufacturing from Mr. Fussell who took the business westward and opened plants in St. Louis, Cincinnati and Chicago.

The expansion of the industry which immediately attracted others, was slow up to about 1900. The first year of the century, however, witnessed a quickening of interest and of growth throughout the country. Ice cream manufacturers began to feel that they represented a distinct branch of American industry and that they had common interests and common problems as a group which were not identified with the interests of the confectionery industry or of the milk industry with which many of them also had affiliations.

Between 1900 and 1910 the annual output of ice cream quadrupled and probably three-fourths of the gain in volume was made after 1905. This expansion was not only represented by an increase in sales activities that stimulated and built up demand but it was largely due to the development of manufacturing science which resulted in a greater production capacity to increase the available supply of ice cream. Enterprising men have brought to the aid of the industry new types of equipment which have been important factors in aiding the manufacturing and distributing processes.

WETMORE-SAVAGE AUTOMOTIVE EQUIPMENT COMPANY

The automobile and radio fields have been responsible for the creation in Massachusetts of an outstanding unit known as the Wetmore-Savage Automotive Equipment Company which while comparatively young in years as a corporation is old in its experience in the industries it represents, and one of the pioneers.

Twenty-five trained salesmen cover Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and a part of Connecticut, for the concern, and the company specializes in equipping service stations, and accessory and radio stores, besides being distributors for many prominent manufacturers in the automotive field.

In planning its new warehouse and headquarters, at 588 Commonwealth Avenue, the concern looked after not only the convenience of its executives and working force, but also that of its customers by taking a lease of 10,000 square feet of land directly in front of the four-story structure to provide parking facilities.

V. C. Bruce Wetmore is president and treasurer; and R. E. DeLoid, secretary of the corporation, which has capital of \$2,000,000, and employs 225 operatives.

In 1925, the Standard Mohair Plush Company was incorporated, with capital of \$100,000, and began the manufacture of plush, in Hyde Park, where forty operatives are employed.

R. J. B. Sullivan is president, John J. Conley, vice president, and E. J. Sullivan, secretary and treasurer, of the corporation.

The same year, the Textile Company was incorporated with F. B. Scribner as president and William M. Mick as treasurer, and at its Hyde Park plant brake linings, and clutch facings and linings are produced.

THE FIRST NATIONAL STORES, INC.

Early in 1926, the Ginter Company, the John T. Connor Company, M. O'Keefe, Inc., and Arthur E. Dorr & Co., all Boston chain-store, restaurant, bakery and provision enterprises, which had been in business for upwards of twenty years, and successfully operating at that time about

1,650 retail stores located for the most part in or near Boston, were consolidated into the First National Stores, Inc., since which time the total number of stores has risen to more than 2,000, all dealing in groceries, vegetables and fruits, and a small but increasing number, purveying meats.

All retail sales are made on a strictly cash basis, and the total in 1926 was over \$59,500,000. The new company is a Massachusetts corporation, is Massachusetts and New England owned, and is managed by New England men.

Immediately after the consolidation, the corporation purchased 530,000 square feet of land in Somerville, and erected thereon a mammoth plant to serve as a central administrative headquarters, manufacturing plant, bakery, and warehouse, the structure being the largest individually operated warehouse in the world. The Somerville plant represents an expenditure of nearly \$3,000,000, and has a capacity of handling in excess of \$100,000,000 of foodstuffs annually.

The area of the roof is materially in excess of five acres, and the total floor area is 484,660 feet. The cubic content is 7,301,000 cubic feet. There are over 12,000 square feet of glass skylights in the roof of this structure in addition to the window lighting area, and the building is so vast that visitors are transported on electric trucks to save time and the long walks required.

The trucking and shipping platform exceeds a quarter of mile in length and over 50 carloads of merchandise can be placed along another platform on the private railroad tracks belonging to the company and adjoining the building.

Situated a half-mile from the Sullivan Square Terminal of the Boston Elevated, this great plant is located within the Boston terminal limits, which means that cars are not subject to shipping or switching charges. Both Middlesex Avenue and Mystic Avenue, on which the building faces, are wide, well paved thoroughfares and free from traffic congestion, so that the trucks are enabled to make a quick getaway. Only in serving the East Boston stores of the company do the trucks need to work through the heavy downtown Boston traffic.

The location chosen has no restrictions against slaughtering hogs, rendering fat or smoking meat, if the company decides to perform these operations, as it probably will.

The power house, which contains the boilers, refrigerating and electrical equipment, cost in excess of \$100,000.

1,000,000 LOAVES OF BREAD EVERY FORTY-EIGHT HOURS

The bakery, perhaps the largest in New England, is capable of producing a million loaves of bread in forty-eight hours of continuous operation. It contains two modern traveling ovens equipped to bake bread by electric heat.

Among the many principal departments under the roof this great warehouse is a complete and modern coffee roasting plant, and automatic machinery packs teas, coffees, cereals, flour and many other articles of bulk foodstuffs that it is customary to sell in packages. The machines are of the most modern mechanical type and were planned and built by a Massachusetts company—The Pneumatic Scale Corporation, Ltd., of Norfolk Downs, which has been developing this type of packaging equip-

ment for over thirty-five years. Foodstuffs are weighed, packaged and checked without being touched by the human hand at any stage of the operation. Cartons are opened, closed and sealed after contents have been automatically weighed and inserted. The machinery guards against incorrect weights, imperfect cartons, and delivers only perfect packages, tightly sealed, to the final packing tables. A modern bottling plant is contained within the building which has an annual capacity of 250,000 cases of various beverages. Another innovation is an electrically operated monorail conveyor system for order assembly.

The manufacturing plant produces hundreds of varieties of foodstuffs. The refrigerating system offers cold storage facilities for all perishable foodstuffs handled by the company, and space is allowed and foundations installed for the eventual manufacture of artificial ice enough to supply all the Greater Boston stores.

A modern cafeteria has been installed for the employees of the building, and a printing plant sufficient in size to do all the printing required in the office of the company, as well as the circulars, window posters and advertising matter distributed through the 2,000 stores is operated by the corporation.

The garage and machine shop care for 100 large motor trucks as well as many other smaller automobiles, and there is storage equipment for 50,000 gallons of gasoline, 48,000 gallons of fuel oil, and twenty carloads of coal weekly.

Every part of the building was planned for future possible development, the foundation and construction of the main plant being heavy enough to support other floors if ever needed. The enormous garage has hidden foundation posts which will permit the warehouse floor to be extended in that direction, if necessary. The power house was so designed that if it ever becomes advisable for the company to make its own electric power, dynamos can be installed on foundations already built.

The present buildings occupy about half of the available land space. The bakery contains 62,170 square feet; the garage and loading section, 60,670 square feet, the assembly floor, 59,220 square feet; the general warehouse, 154,880 square feet; the manufacturing department, 133,700; the machine shop, 8,410 square feet; and the boiler house, 5,000 square feet.

The assembly floor, built around a monorail system which collects each outgoing order on a small electric train, contains enough of each of the 600 or more items carried in stock to supply one day's orders. The bakery has a rated capacity of one million loaves a week in a single eight-hour daily shift.

The bakery, which operates with a minimum of hand labor, bakes bread by electricity, and cools, wraps and assembles it automatically. The manufacturing plant contains complete mechanical equipment for making preserves and condiments, cooked foods and other similar dainties.

A \$1,500,000 ADDITION BUILT IN 1929

When the Somerville plant was completed it was thought to be large enough to care for the company's business for twenty years to come, but in 1929 work was begun on a \$1,500,000 addition, the new building having a 220-foot frontage on Mystic Avenue, and extending back to the company's private railroad sidings. There is also a wing 200 by 80 feet

which connects the original plant with the new structure, affording additional space for the manufacturing plant, which had developed beyond its original capacity.

The basement and the first floor cover the entire area occupied by the new building and its wing. The wing basement is used for processing and repacking fresh fish and the main part of the new basement is devoted to a pickling cellar for smoked and cured meats.

The first floor of the wing is used for sorting and handling fresh vegetables, and the first floor of the new main building contains the meat coolers, cutting rooms, selection and storage rooms and shipping facilities. All meats are under refrigeration all of the time until loaded on trucks for shipment to the stores, and there is space for hanging 1,500,000 pounds of beef.

A third story, 240 feet deep and 80 feet wide, over a portion of the new main building, is devoted to the manufacture of sausage, frankfurters, etc., bacon slicing and the cooling of hams and bacon. The connecting wing is used for the increased manufacture of food products.

The smoking of hams and bacon is carried on by the most modern smoke-house equipment, known as the "continuous smoke-house escalator" method, insuring uniformity in curing and flavor. The entire plant was planned and built to meet the full requirements of the United States Bureau of Animal Industry.

The shipping platforms of the addition accommodate twenty-eight large auto trucks, one-half of them at the vegetable platform, and the railroad sidings for meats and vegetables hold five freight cars each.

The retail end of the Dorr meat division of the company, hitherto occupying the building at 5 Commercial Street, Boston, was moved to Somerville and the Commercial Street building is now given over entirely to the wholesale business.

To the right of the addition an attractive gasoline filling station was built by the First National Stores.

ADDING TO ITS DOMAIN

In 1929, the corporation effected one of the largest mergers yet brought about in the chain store field, when it acquired the Kroger Grocery Company and the American Store Company whose assets, with those of the First National Stores, Inc., approach \$120,000,000 and whose annual sales are in the neighborhood of \$400,000,000. Previously, the First National Stores, Inc., had acquired the Mayflower Stores, Inc., of Rhode Island, which operated 191 stores, in that state, The Kroger Grocery Company absorbed in 1928 and 1929, prior to the merger, the Consumers Sanitary Coffee and Butter Stores, the Piggly-Wiggly Ellis Company, the Three Rivers Grocery Company in addition to the Piggy-Wiggly Corporation, Cox Stores, the Dunn Mercantile Company, the Bowes Stores of Memphis, the Keyes Chain, of Oshkosh, Wis., and others, and was then operating 5,558 stores.

At the end of 1928 the American Stores Company operated about 2,600 stores against 2,133 at the end of 1927 its field including Philadelphia, Eastern Pennsylvania, New Jersey, Delaware, Maryland and the District of Columbia. In addition to grocery stores the company operated three modern bakeries. On March 31, 1929, the First National Stores, Inc., were operating 1,460 stores and combination markets in Massachusetts,

237 in Rhode Island, 126 in New Hampshire, 91 in Maine, 45 in Vermont, and 43 in Connecticut, a total of 2,002. This figure was raised to approximately 2,350 later that year, when The Economy group of Connecticut, was absorbed.

The net profits of the First National Stores, Inc., for the year ended March 31, 1929, were the largest in the company's history, amounting to \$2,904,884 after all expenses, including depreciation and taxes, equal after preferred dividends of \$4.24 per share on the common stock as compared with net profits of \$1,551,919, or \$2.09 a share on a lesser number of common shares, in the preceding year.

The retail store sales for the year also established a new high record of \$75,884,639, an increase of \$11,438,677, or seventeen per cent, over 1927. After the payment of dividends and allowing for sinking fund for the seven per cent first preferred stock there remained a surplus of \$1,519,933, bringing the surplus account to \$3,237,133.

The consolidated balance sheet as of March 31, 1929, showed total assets of \$17,314,495, an increase of \$3,356,876 over 1927. Current assets were \$10,107,296, and current liabilities \$4,090,085, leaving a net working capital of \$6,017,211.

The officers of the corporation are Charles H. Farnsworth, president, Augustus F. Goodwin, chairman of the board, Charles F. Adams, treasurer, Arthur E. Dorr, James C. Duane and Martin Curry, vice presidents, Ralph F. Burkard, assistant treasurer and Arthur O'Keefe, secretary.

THE EAST BOSTON LAND COMPANY

In November, 1928, there was consummated a project which means much to the future industrial development of East Boston, when the old East Boston Land Company deeded to the Boston Port Development Company over 55,000,000 square feet of land—approximately one-half the entire area of the East Boston district, and a large portion of the terrain being located on deep water, with available rail connections over the B. & A. and B. & M. systems, as well as opportunities for the creation of dock facilities on the main channel unequalled on the Atlantic Coast.

The promoters plan the development of a new flying field, containing an area of 10,000,000 square feet, one section to be used for passenger and mail service and the other for commercial and foreign business, this location being adjacent to the airport acquired by the City of Boston from the Commonwealth of Massachusetts, and the two affording runways 4,000 feet in length, making the facilities the most modern in this country. Surrounding these fields are between four and five million square feet of land available for the development of factories for aeroplane industries.

This great East Boston development will go forward in step with the \$10,000,000 traffic tunnel to East Boston, the appropriation bill for which was signed in 1928, and which, when completed, will confer enormous benefits on the East Boston, Chelsea, Revere and Winthrop areas and the entire North Shore. The new development company plans highway connections through its property along the route of the Boston & Revere Beach R. R. to the North Shore.

In addition to providing facilities for large industrial enterprises, a substantial portion of the land is suitable for the housing of several thousand families.

THE A. & P. TEA COMPANY'S NEW HEADQUARTERS

On June 11, 1928, the Great Atlantic & Pacific Tea Company formally opened a new five-story re-enforced concrete structure, containing 130,000 square feet of floor space, in Dorchester, of which total 13,000 square feet are under refrigeration and devoted to the meat handling department, which supplies 300 markets operated in this district, and to perishable foods, the egg-candling department, capable of handling 20,000 cases of eggs each week, being a feature of the plant.

Constructed to handle the supplies required by 600 stores operated by the company on Cape Cod and the South Shore, the Dorchester plant can handle on its unloading platforms twenty-five carloads of food each day, while 140 trucks leave there daily, with supplies of all kinds for the A. & P. Stores. One floor of the building is devoted to the offices of the New England division and the Boston unit, and the structure houses 500 employees.

The Dorchester plant is the ninth to be erected by the company in New England, and in addition four bakeries supply the district. The Somerville plant of the company, which previously handled supplies for all the Boston stores, now serves 500 retail branches north and west of this city.

SEARS, ROEBUCK & CO.

Up to 1928, Sears, Roebuck & Co., of Chicago, which had served its New England customers through its Philadelphia headquarters, erected a magnificent mail order plant and retail store, at Brookline Avenue and Audubon Road, from which since the fall of that year, the corporation has handled its business in the six northeastern states. Upwards of 2,000 employees are carried on the roll there, and, with the exception of about 100 executives and managers handling key positions, all other workers were selected locally.

President Kittle, of Sears, Roebuck & Co., stated at the time the venture was launched that the corporation specials in coming to Boston believed such a course was a good business move on the part of the company, and that the primary object of erecting so large a building was to render better service to New England customers who for years had been providing a large business for the concern.

In 1928, the New England Metal Cabinet Company of Palmer purchased 19,238 square feet of land, with a railroad siding, in South Boston, and erected a branch factory where it has carried on operations since May 1, of that year.

THE SHELL EASTERN PETROLEUM PRODUCTS COMPANY

In 1929 the assets of the New England Oil Refining Company were acquired by the Shell Eastern Petroleum Products, Inc., a subsidiary of the Shell Union Oil Corporation, an American organization controlled in turn by the Royal Dutch Shell Corporation, an international enterprise, which is 60% Dutch and 40% British.

The local company established its home office, at 141 Milk Street, and serves not only the New England territory, but the Northeastern Atlantic Coast as well. The properties acquired included the retail distributing system originally installed by the New England Oil Refining Company its oil refinery located in Fall River, and a number of bulk terminals.

The officers of the new corporation are substantially the same as those of the old New England unit. A. F. Carter is president; W. J. Filer, vice president in charge of sales; N. F. O'Brien, secretary and treasurer; H. W. Boynton, distribution manager; T. S. Marshall, advertising manager, and H. A. Browne, transportation manager.

THE READVILLE SHOPS OF THE N. Y., N. H. & H. R. R. COMPANY

Located in the Readville district of Boston, are the shops of the New York, New Haven & Hartford R. R. Co., the largest in the territory served by this transportation company, and completely equipped with machinery to build freight and passenger cars, and one of the largest and most practical locomotive shops in this section of New England.

In 1929 the company carried through a program which called for the expenditure of approximately \$3,500,000 for new rolling stock, practically all of which was built at the Readville shops, the largest item calling for the construction of 1,591 steel underframe box cars, ninety-five steel underframe caboose cars, twenty-five steel underframe flanger cars for snow removal, twenty-five steel underframe milk cars, and twenty multiple unit steel passenger train motor cars, and a number of steel transformers, which will be installed on the road's lines between New Haven and New York.

THE UNITED STATES GYPSUM COMPANY

It appears somewhat incongruous to those who have witnessed the erection, within the past two or three years, of a \$2,000,000 plant on the Mystic River water front, having a total floor area of 125,000 square feet, to incur so great an expenditure in brick, steel, mortar, and equipment if there exists no justification on the part of the promoter and owner—the United States Gypsum Company—to invest so large a sum if it is true, as many would-be prophets assert that this section of the country does not warrant extensions of manufacturing facilities and offers no future to new concerns.

But it is quite significant that at the time the corporation officials acquired five and a quarter acres of deep water harbor frontage in the Charlestown district, from the Boston & Maine R. R. Co., and again on the occasion of the formal opening of the completed plant, in March, 1929, they should publicly announce that this mill and warehouse had been built to meet a large and growing demand for the company's products in this section.

The machinery that was installed, consisting of many large and heavy pieces of apparatus provided for the manufacture in the new mill of sheet rock, rock lath, gyplap, red top plaster, Oriental stucco, plastint, textone, thermofill, red top metal lath, sabinite acoustical plaster, ivory Keene's cement, sheet rock tile board, and standard X plastering system. In other words a complete line of United Gypsum products is obtainable from the Boston mill in any quantity, or in mixed car shipments, and the plant offers evidence of the firm belief in the future of New England, and in the building industry of this section of the country.

The site of the plant was selected because of its waterfront advantages, coupled with the further fact that it was easily accessible to the tracks of the Boston & Maine R. R., a double line of rails extending directly into the mill. The tanks, or "silos" for the storage of gypsum rock are

close to the dock, enabling the company to handle the raw material directly from the steamers, and the mechanical equipment is of the latest labor-saving type. The mill is now producing 1,000 tons of fireproof building material daily, and employs upwards of 300 men. The plant includes a dozen buildings of first-class mill construction and of the fireproof type and covers approximately four acres with a frontage on the thirty-foot channel, of 409 feet, and a right-of-way to the Chelsea viaduct. The company has twenty-five plants in the United States and employs 20,000 persons, and has capital of \$35,000,000. S. L. Avery is president, and R. G. Bear, treasurer and secretary.

THE DRAKE BAKERIES, INC.

The Boston plant of the Drake Bakeries Company, is located at 85 Savin Street, Roxbury, an enterprise which had its inception in 1896, and which is a large user of apparatus and machines manufactured by such Massachusetts producers as the National Equipment Company, and the Package Machinery Company, both of Springfield. The corporation has capital of \$5,000,000 and employs 350 hands. R. D. Ward is president, J. H. Drake, vice president, A. W. Drake, secretary, and E. C. Balche, treasurer.

THE ALBERENE STONE COMPANY

One of Boston's unique industries is the Alberene Stone Company, whose product possesses a long and interesting history. In the late seventies and early eighties there was discovered and opened in Albermarle County, Virginia, a deposit of stone of peculiar and remarkable qualities in that it was weather, heat and time proof, and easily worked, as was proved by Indian bowls and other utensils carved from the material by the use of the crude and primitive tools of the early aborigines. While soft enough to be easily shaped and fabricated, it was found to be so dense and close-grained as to have a crushing strength equal to that of granite, as well as being non-absorbent and non-staining and, in chemical characteristics, acid and alkali-proof.

John G. Porter early saw the commercial possibilities of a material possessing these unique qualities, and convinced of the large potential markets existing in the industrial, architectural and scientific worlds, he associated himself with a group which later became known as the Alberene Stone Company, with D. J. Carroll as president. This material has since been quarried and marketed continuously, for more than forty years, by this organization under the name "Alberene Stone," a word coined from the name of the Virginia county where the deposit lies, and from the name of one of the pioneers in its development, a Mr. Serene.

The original small holdings were increased by the repeated acquisition of other properties along the vein, until today upwards of 6,000 acres containing the entire deposit of this exclusive material is owned by the Alberene Stone Company, which quarries it in what is conceded to be the most modern plant in the country and finishes it in its many marketable forms in mills completely equipped with special machinery, at Schuyler, Va., while three large branch factories are located in Boston, New York and Chicago, completely stocked and equipped with the product.

The only known deposit of Alberene stone is this vein, originally opened in Albermarle County and since found to extend into Nelson

County adjoining—approximately five miles in length, of varying widths up to 200 feet, and of unknown depth. Sufficient material is in sight to supply all requirements for several hundred years, even at the present rapidly increasing rate of demand. It is a remarkable tribute to its merits to say, with truth, that in this “age of substitution” no other natural stone, nor any artificial material, combines within itself so many qualities essential for the performance of certain definite and important functions in the fields of industry, science and architecture.

In the laboratories of colleges, research institutions and industrial plants everywhere, it is helping in education, in investigation and experiment, in the betterment of processes, and in the maintenance of standards; in hospitals and scientific institutions, it lends its aid in the laboratory processes by which health is conserved and pure foods are assured; in electrical construction it provides safety for men and equipment; and in the sanitary work in buildings, it is safeguarding health and at the same time providing the maximum of durability. It is a natural product, ages in the making, and used as it comes from nature’s laboratory—quarried in blocks, sawed into slabs of various thicknesses, and fabricated in units of convenient form and size—without crushing, grinding, burning, or other processing to change its natural characteristics. In fact, it is in these natural characteristics—unchanged and unchangeable—that its many great values lie.

At the Virginia plant a private standard-gauge railroad has twenty-three miles of trackage, and two hydro-electric plants owned by the company on the Rockfish River, and several auxiliary steam-electric and Diesel-electric plants, furnish electric light and power for the quarries, mill and town. The population of Schuyler depends entirely upon the Alberene Stone Company for its support. The town has schools, churches, a hospital, a hotel, playgrounds and other public benefits built and maintained by the company. The personnel of the mill and quarries affords many instances where two and three generations in a family are regularly on the company payroll. The spirit of the organization—all of whom are native-born Americans—is shown by the fact in over thirty years there has not been a single “labor dispute.”

The Boston plant is located at 35-37 Stillings Street and 100 operatives are employed by the concern.

J. J. Brown is president; R. G. Grothe, secretary, and S. D. Montgomery, treasurer.

THE FISH INDUSTRY OF BOSTON

While Massachusetts has developed no great mineral resources, and while her forests have given way to factories and homes, the Commonwealth still possesses at her front door the world’s greatest fishing grounds.

The North Atlantic fisheries of the American seaboard stretch from the Newfoundland banks to the Delaware River, and represent the major sea resources of the Atlantic Coast, and produce annually nearly 800,000,000 pounds of food.

The Commonwealth itself has an area of but 8,266 square miles, but the Georges Fishing Banks alone, located ninety miles southeast of Cape Cod, include 8,498 square miles of the finest fishing grounds in the world, and from this area of water millions of pounds of cod, haddock, pollock,

cusk, hake, flounders, sole, mackerel, swordfish and other varieties are harvested.

Within a comparatively few months one steam trawler arrived at the Boston Fish Pier and discharged 191,741 pounds of fancy fish, mostly codfish and haddock, all caught within thirty-six hours, and this vessel was but one of a large fleet running to the pier, where over 200,000,000 pounds of fresh fish are landed annually.

SOME SIGNIFICANT FIGURES

In September, 1927, alone 881 trips of Boston, Gloucester and Portland fishing vessels yielded 23,000,000 pounds of fresh and 130,000 pounds of salt fish valued at \$793,000 and \$6,000 respectively. The leading items of fresh fish included 5,197,000 pounds of cod, valued at \$175,000; 11,693,000 pounds of haddock, valued at \$193,000; and 2,234,000 pounds of mackerel, valued at \$221,000.

Compared with the same month of the previous year there was an increase of 2,700,000 pounds, or 13 per cent in fresh fish and a decrease of 340,000 pounds, or 12 per cent in salt fish. Haddock landings were about 4,500,000 pounds greater, cod 500,000 pounds less, and mackerel 3,000,000 pounds less than in September, 1926.

The total fresh fish landings for 1927 to the end of September were over 203,000,000 pounds, as compared with 182,000,000 pounds to the same date, in 1926. Cod landings in 1927 were about 12,000,000 pounds below 1926, haddock about 29,000,000 above, halibut 1,000,000 above, flounders 1,000,000 above, and mackerel and swordfish about the same as in 1926.

On the opening day of the \$3,000,000 Boston Fish Pier, March 30, 1914, two million pounds of fish were received, packed, sold and shipped. Fifty million dollars' worth of fish was taken out of New England waters in 1928, a total which clearly indicates the importance of this industry to this section.

THE GROWTH OF THE INDUSTRY

The fishing trade started with the landing of the Pilgrims. It was then one of fish, fresh caught, to be used immediately. The inability to hold the product under the conditions then obtaining caused the colonists to salt the product in fair weather in order that they might have the delicacy in foul weather and through the winter. Thus came into being the branch of the industry which for a time held the major place. The demand for salt fish was so great in the western counties of England that a cargo of salt was shipped to this country, landing at Marblehead, then the greatest seaport of New England. The commodity was for the purpose of salting codfish, the only kind then used. Thus the fishing industry became New England's chief trade and brought the first money to this country for exported products.

Before modern marketing methods came into the industry it would have been reasonable to have rated its importance by the cost of its raw product, since there was no manufacturing stage between catching the fish and the sale to the housewife. The fish were taken from the holds of the boats, packed with ice in boxes, and shipped to the market. There the products were spread out on tables, and from this pile the housewife chose the one she desired. Today consumers may buy fish from

a modern, sanitary store, where it is either displayed whole, dressed or filleted in any of these forms, either without any method of preservation or perhaps frozen.

SALT AND FRESH FISH

Lack of transportation facilities in the early days made it impossible to transport fish. The first instance we have of the shipping of the food any distance was from Marblehead to Montreal in the winter time by dog-sled. Salt fish when properly cured, however, could be transported any distance. This industry became centered at Gloucester, and made it the greatest salt fishing port in America, a position which it occupies to this day. With the improvements in transportation it has been possible to transport fish farther and farther from the source of supply. This naturally caused the fresh fish industry to center in Boston, the largest commercial center which had adequate transportation facilities, and the city thus became the leading seaport of the country for landing of sea fish, a position which it is destined to hold because of its geographical location and its ample transportation facilities.

Improvement in expediting shipments increased the demand for fish to such an extent that the old method of hand fishing, which was amply rapid for salt fishing, proved inadequate and thus led to the equipping of the schooners with dories where they could range over a wider territory and secure more fish. By this method each fisherman uses 500 or more hooks. Within the past few years the modern beam trawler has been brought into the industry. This type of vessel fishes by dragging a huge net behind it, scooping up the fish from the floor of the ocean. By this system fishing can be continued through stormy weather when all other methods must be abandoned.

Great strides have been made in the regularity of fishing trips, due to the fact that the old sailing vessel which depended on wind for its propulsion has passed out of the picture and today all fishing vessels are equipped with modern engines of ample horsepower to enable them to carry through their trips on schedule. Not only has this removed practically 90 per cent of the hazards of the work, but it has provided a steadying influence for the industry.

THE ADVENT OF THE FILLET

The trend toward modern improvements in marketing has shown to American housewives the desirability of buying goods in packages where the products are not subject to contamination from the time they leave the producing ground until they reach the kitchen. Less than a decade ago the fillet came into the fishing industry, and Boston led all other fishing ports in developing this method.

The genius, vision and initiative of Dana F. Ward were the primary factors in revolutionizing the fishing business of the Hub, for it was he who originated, only a few years ago, the plan of packing and distributing fresh ocean fish in fillet form for widespread commercial sale. After a period of experimentation, Mr. Ward finally evolved a practical method of boning slices of fish direct from the sea, wrapping them in pure vegetable parchment paper and shipping them in thirty-pound iced tin containers so that the ice would not touch the fish and today these fillets go to every state in the Union, and account for a part of the rapid

and healthy growth observed in the fisheries, the sales in Boston alone jumping more than 23,000,000 pounds in a nine months' period in 1927.

Immediately on being landed, the fish are cleaned and dressed, and the thick meaty sides of flesh are cut, washed in a solution of salt water, wrapped in vegetable parchment paper, and placed in water-tight tin cans. These cans, surrounded by ice, are placed in wooden boxes and shipped. The housewife in buying the fillet pays a higher price per piece, but actually is paying less for the edible portion. No longer are there transportation charges on the head, tail and fins. These formerly waste products are now put into fish meal and by-products, which pay some of the expenses of the company and make a saving in transportation charges. Such progress has been made in the methods of filleting and in the merchandising of the product that fully one-half the haddock which comes to port these days is marketed in that form. These fillets reach the market within twenty-four hours, serving 75 per cent of the population of the United States. Thus fresh fish are available over an increased territory because of modern methods.

OTHER RECENT DEVELOPMENTS

Great strides have been made in refrigeration. Formerly fish were kept as long as possible and then the unwise dealer froze the product to save it. Within the past few years a new system of freezing has been developed whereby fish are frozen in a very few minutes. This method enables the fish to be preserved in a very much finer condition, since there is no breakage of connective tissue sacs or loss of valuable juices. Fish frozen by this method reach the market mainly as individually frozen fish, or individually frozen fillets. When thus processed, there is no let-down in quality, even though they be kept frozen for months. Therefore, it is possible to ship fish from New England to any city in the world having adequate freezing plants to hold the fish when they arrive at a sufficiently low temperature to prevent their thawing. This equipment is to be found in practically every city in the United States.

Dana F. Ward made his first shipment of fillets to Washington, D. C., in 1921, and in February, 1922, John C. Wheeler, another Boston fish operator, inaugurated similar shipments.

Today, as a result of the adoption of the ideas of these two Boston men, over forty firms are engaged in the package-fish industry, eleven being located in this city, eleven in New York, four in Portland, Me., and one each in Gloucester and Provincetown, with others at different ports.

During 1926, according to a survey made by the U. S. Bureau of Fisheries, 46,000,000 pounds of fresh and frozen fish were converted into 18,300,000 pounds of prepared products in the cities canvassed. The prepared products consisted of 14,630,000 pounds of haddock, 1,400,000 pounds of cod, 800,000 pounds of hake, cusk and pollock, 800,000 pounds of flounder and sole, 200,000 pounds of mackerel, 200,000 pounds of sea trout, 170,000 pounds of blue pike, and 100,000 pounds of miscellaneous fish, including croakers, groupers, fresh-water sheepshead and perch.

Included in the list of Boston concerns now engaged in purveying packaged fresh fish to the nation are the Ward Fisheries, Inc., Russo & Sons, the Whitman, Ward & Lee Company, the Atlantic & Pacific Fish Company, the John R. Neal Company, the New England Fish Company, which has operated for sixty-three years, the O'Donnell Company, the

P. H. Prior Company, which was founded fifty-seven years ago, the Atlas Fish Company, the Beacon Fisheries Company, and others.

The Bay State Fishing Company is one of the large local units, and operates a fleet of eighteen steam trawlers, each equipped with wireless and large enough to hold 100 tons of fish, and whose crews brought to Boston, in 1928, 75,000,000 pounds of fresh fish. The Bay State Fishing Company's trade name, "Forty Fathom," is familiar to millions in practically every state east of the Mississippi, in fact the zone of distribution has been increased to such an extent that people living in such states as Oklahoma and Texas, are now served by it. The company's newly equipped plant at East Boston is the largest and most modern packing factory of its kind in the United States, and is operated on the same plan as the model automobile plant, each employee specializing in one particular operation from start to finish. One cannot help but marvel at the great speed with which each fish is made ready for shipment to the market. For the greater part the process is automatic, especially designed machinery performing all the handling operations.

In earlier years Boston oyster dealers planted their summer and fall supply in Wellfleet, having them shipped by sail packet to the Boston market. The supply first came from Scituate and Plum Island and later from the waters of Virginia and Maryland. About forty years ago Boston oyster dealers started to plant Connecticut oysters at Wellfleet, and from these have come large quantities of seed. D. Atwood & Co. specializes in Wellfleet oysters and also receives Rhode Island oysters direct from their shucking house at Warren, R. I.

THE PRESENT-DAY FISHING INDUSTRY OF BOSTON

From the office of the Bay State Fisheries Association, located in the seaward end of the administration building of Boston's unrivaled fish pier, its president, Edward H. Cooley, looks out upon an endless panorama of vessels going to and coming from the Grand Banks, and reflects upon the phenomenal fishing business of New England, which he has seen grow into a \$50,000,000 business annually.

For many years the industry showed but little progress and it was essentially a trans-shipping business where the fish following the catches were brought to port. There they remained in the same condition as when hauled from the Atlantic and were packed in barrels or boxes and shipped to retailers throughout the country.

With the introduction of fillets in 1921 the entire mechanics of the business changed and it was suddenly transformed into a manufacturing industry. The process of filleting consists in the cutting off of the boneless and meaty side of the fish, leaving the waste material in part for by-products.

More than 25,000 persons are now employed in the fish industry of this section and the fishing fleet has grown to 300 vessels, including many new 150-ton Diesel trawlers and the wooden sail and "Kicker" boats. In 1928 the increase in the Boston fishing fleet was approximately twenty-five per cent and it is predicted that the construction of at least one hundred new trawlers will be undertaken in 1929 and 1930.

The trawlers are powered with the latest model in American Diesel engines and their equipment totals millions of dollars. With the fishing industry reaching a new high-water mark New England is already mov-

ing forward to heavier tonnage ships which can cruise the Seven Seas and fish anywhere in international waters.

The revolution in the fishing industry brought about by the fileting process is shown by the statistics of the industry. While 50,000 pounds of filets were marketed in 1921, more than 60,000,000 pounds were sold in 1928. During the first eight months of the latter year there were 3,845 arrivals at the Boston Fish Pier, landing a total of 153,991,985 pounds of fish. In the same eight months of 1929 there were 3,901 arrivals landing 181,687,112 pounds of fish.

Monday, October 14, 1929, was the biggest day that the Boston Fish Pier has ever experienced with 2,750,000 pounds of fish brought into that port by a fleet of seventy-three boats.

SOME OF BOSTON'S PROGRESSIVE MANUFACTURERS

The Pelton Knitting Mills, Inc., with capital of \$100,000 manufactures men's and women's sweaters, bathing suits and athletic goods, at the plant 116 Bedford Street. N. Pelton is president, and J. Pelton, treasurer.

The Pilgrim Knitting Mills manufacture men's sweaters and men's and women's bathing suits, at East Boston, the plant being equipped with forty-five knitting and fifty sewing machines. It employs seventy-five operatives. S. P. Kaplan and L. A. Barron constitute the partnership.

The Bay State Insulated Wire & Cable Company has its plant in Hyde Park where insulated wire is manufactured. J. H. H. McNamee is treasurer of the corporation.

The Robert Bishop Manufacturing Company is engaged in the production of wicking, wiping cloths, tufting yarn, coarse twine, calking cotton, and cotton and wool waste at its South Boston plant, located at 157 West 6th Street. Robert Bishop is president and Richard Bishop, treasurer. The concern employs seventy-five hands.

C. H. Noone & Co., owned by A. W. Noone is engaged in the manufacture of wide duck sheetings, and cotton specialties, at its plant, located at 850 Summer Street.

The American Type Foundries Company maintains its New England selling branch, at 270 Congress Street, in charge of J. W. Phinney.

The Puritan Manufacturing Company manufactures high speed wax and dry thread machines for shoe, harness, luggage, upholstery and sporting goods producers, and is a branch unit of the Torrington Company of Connecticut. It has capital of \$26,000, and its plant is located at 210 South Street.

The Barrett Company maintains a Boston sales office at 11 Beacon Street, and operates a factory in Everett where coal tar products, roofing, and paving materials are produced and where 300 operatives are employed.

In 1929 Rainbow Light, Inc., a subsidiary of Rainbow Luminous Products, Inc., of New York City, expanded the facilities of its Boston factory, at 3166 Washington Street, in order to take care of a complete luminous tube service in New England territory.

The Bellevue Knitting Mills, of West Roxbury, erected a substantial addition of brick and cast stone to its plant, in 1929, fifty-six by seventy-six feet in dimensions.

The Cross Paper Feeder Company engaged in the manufacture of automatic feeders for large knitting processes and folding machines followed the invention of these devices by Frank L. Cross, and the corporation has

capital of \$100,000. H. A. Phinney is president, Walter W. O'Hara, secretary, and Herman F. Buckman, treasurer.

The Bay State Upholstering Company has its main office and New England factory, at 100 Business Street, Hyde Park, with showrooms at 152 North Street, Boston, and branches in Philadelphia, New York, and Providence. It has grown to be the largest manufacturer of parlor furniture in the eastern states, employing approximately 500 workers, and its production facilities are such as to enable it to complete the manufacture of a three-piece suite every three minutes, from the crude log to the finished frames, and from the raw silk and wool or woven fabric to the finished upholstery.

The Tribble Cordage Mills, Inc., of 38 Chauncy Street, are engaged in the manufacture of clothes lines, mops, twines and sash cord and employ seventy-five operatives. A. L. Tribble is president; J. J. Bumstead, treasurer; and E. C. Tribble, secretary. The corporation's plant is located in Woburn.

One of the district offices of the Diehl Manufacturing Company of Elizabethport, N. J., is maintained at 76 Kneeland Street, where facilities are available for the maintenance of motor stocks and for a completely equipped service department.

The Adams & Swett Cleansing Co. located in Roxbury, employs thirty operatives in the cleansing of rugs, being efficiently managed by Mrs. Mabel Adams Furniss, who is president and treasurer of the corporation.

The headquarters of the American Brick Company are located at 177 State Street and the factory operations are carried on at Medfield. The corporation has capital of \$500,000 and employs sixty hands. George D. Dutton is president, Arnold A. Robert, Jr., treasurer, and Walter H. Foster, clerk.

The American Shoe Machinery Co. has its plant at 200 Marginal Street, East Boston, where it produces shoe machinery of up-to-date types. The corporation has capital of \$300,000. Wallace C. Wright is president, James H. Hodder, secretary, and J. Frank Goodwin, treasurer.

The Boston headquarters of Bailey & Weston, Inc., manufacturers of window shades, shade cloth and rollers, is at 83 Washington Street North, and the factory is located in Abington. H. E. Bailey is president and C. K. Thurston, treasurer.

The Bancroft Walker Co. ranks as one of Boston's largest and most successful producers of women's shoes, having capital of \$500,000 and employing 600 operatives. E. P. Walker is president, J. W. Johnson, secretary, and A. F. Bancroft, treasurer and vice president.

The Bicknell & Fuller Paper Box Co. has capital of \$100,500 and employs 150 operatives in the manufacture of paper boxes. Charles E. Fuller is president and Alfred J. White is secretary and treasurer.

The C. S. Binner Corporation employs thirty-five hands in the production of manifold books and loose leaf systems. A. E. Gregg is president and treasurer, and Benjamin Phillips, secretary of the corporation, which is capitalized for \$37,500.

For more than a generation Bliss, Fabyan & Co., Inc., has been one of Boston's leading enterprises in the manufacture and marketing of cloth goods, rayon and celanese fabrics. S. Robert Glassford is president, E. L. Hopkins, vice president, and P. Y. DeNormandie, treasurer.

The Blue Diamond Materials Co. has its Boston headquarters in the

Statler Building, and another office at 278 Gardner Street, West Roxbury. At the plant in Malden ready mixed mortar and plaster are manufactured. The corporation has capital of \$100,000. Enoch E. Neal is president, and William H. Hastings is treasurer.

Macaroni and spaghetti are produced by the Boston Spaghetti Manufacturing Co., which concern employs 35 operatives in its 15 Cross Street plants. M. La Marca, Joseph La Marca and Salvatore Scarpaci are the partners in the enterprise.

C. I. Brink, of which concern John C. Brink is manager, employs 75 hands in the manufacture of signs, time switches and flashes.

The F. L. & J. C. Codman Company has capital of \$55,000 and employs seventy-five operatives in the production of buffing and polishing wheels. S. T. Codman is president and J. A. Clarke is treasurer of the corporation.

One of Boston's fast growing manufacturing corporations is the Colonial Can Company, now employing at its plant, at 381 Congress Street, upwards of 150 operatives in the production of plain and lithographed tin containers, much of the machinery being of the company's development and of a most ingenious type. The Boston office is located at 213 Congress Street. Charles H. Campbell is president and treasurer, and Harold B. Campbell is secretary.

The Compressed Steel Shafting Company has capital of \$100,000 and employs thirty operatives in the manufacture of hot rolled and cold drawn steel. Frank F. Streeter is president and treasurer, Kenneth S. Billings, vice president, and John J. White, secretary, of the corporation. The up-to-date plant of the concern is located at 1587 Hyde Park Avenue in the Readville section of Boston.

Capitalized for \$382,100 and employing upwards of 250 operatives, the Cox Confectionery Company takes rank as one of the larger local units in the confectionery industry, its specialty being chocolates. William S. Cox is president and treasurer, and Edward B. Ricketts is vice president and clerk.

The Dickerman Box Company has its Boston headquarters at 32 Garrison Street, and its plant at 26 Lansdowne Street, in Cambridge, where upwards of 300 operatives are employed in the manufacture of paper boxes. Lewis W. Hall is president, and Emerson L. Dickerman is treasurer.

A concern that has added much prestige to Boston as being the habitat of progressive photo-engravers is the Donovan & Sullivan Engraving Company, whose plant is located at 235 Congress Street, where thirty hands are employed in the production of half-tone and live plates for all kinds of printing, color engraving in two, three and four colors, process plates and Ben Day Color Plates. Peter A. Sullivan is president, and Joseph P. Donovan is treasurer of the corporation, which numbers among its customers many of the leading industrial and commercial establishments of the United States.

The Electric Blower Company, owned by Frank A. MacCallum, manufactures electric blowers and fans at its plant at 352 Atlantic Avenue.

For many years Geo. H. Ellis, Inc., has ranked as one of the city's leading printing establishments. The corporation has capital of \$75,000 and employs upwards of 125 operatives. Albert W. Finlay is president and treasurer, and Grace Ellis Finlay is secretary, they, with Hon. George H. Ellis, the founder, constituting the board of directors.

Frederick and Willard Estabrook constitute the famous firm of Estabrook & Eaton, manufacturers of cigars, whose area of distribution is wide.

Five hundred employees are carried on the roll of the Farrington Manufacturing Company at its Jamaica Plain plant, where metal specialties of many types are fabricated. The corporation has capital of \$500,000. George E. Farrington is president, H. J. Farrington is treasurer and general manager, and George E. Hills is secretary of the corporation.

A concern that has long been famous for its sizing and adhesive products is the Feculose Company of America, which maintains its Boston offices at 88 Broad Street, while its manufacturing operations are carried on at its plant in Ayer. The corporation has capital of \$122,350. A. N. Hood is president and John T. Nightingale is secretary.

The General Fireproofing Corporation, whose plant is located at Youngstown, Ohio, has its New England headquarters at 74 Franklin Street, where upwards of sixty employees are carried on the payroll. The concern has capital of \$50,000. Its specialty is the production of steel office furniture, metal lathe, etc. W. H. Foster is president, Lionel G. H. Palmer vice president, R. M. Bell, treasurer, and C. J. Baatz, clerk.

Capitalized for \$360,000 the Goudey Gum Company employs upwards of 75 operatives in the manufacture of chewing gum. E. C. Goudey is president and D. A. Stevens, vice president, and they, with G. W. Wilson and Edward Pence, constitute the board of directors of the corporation, which has attained constant growth since its inception a few years ago.

The Grant Gear Works, Inc., of South Boston, is one of Boston's dependable industries, constantly employing upwards of 100 men in the manufacture of gears. The corporation has capital of \$75,000. J. J. Lannon is president, H. Mitchell, secretary, and R. J. Cromwell, treasurer.

Griffith-Stillings, of 368 Congress Street, has capital of \$40,000 and employs 75 operatives in carrying on its printing and direct mail advertising activities. George H. Wood is president and Augustus E. Weller, treasurer.

F. S. Hardy & Company is engaged in the production of automobile specialties and electrical supplies.

Soaps and soap powders are manufactured by the Hercules Kalon Company, Inc., at its plant located at 25 Lewis Wharf. The corporation has capital of \$40,000. Charles P. Powers is president, Howard M. Cunningham, vice president, and Llewellyn Mills, treasurer and secretary.

Fifty employees are engaged in the manufacture of paper boxes at the plant of Myrton O. Hill & Co., at 11 Grosvenor Place. The corporation has capital of \$41,000. Myrton O. Hill is president and treasurer, and Lewis B. Hill is secretary.

Since 1865 the Hodge Boiler Works, whose plant is located at 99 Sumner Street, East Boston, has been engaged in the manufacture of the celebrated Hodge fire tube boilers and its later products—welded steel heating boilers. The concern also operates the Roberts Iron Works, in Cambridge, and at both plants employs upwards of 125 men. It has capital of \$225,000 and in addition to its specialty it also manufactures tanks, and does all kinds of plate and sheet iron work. Henry H. Lynch is president and John E. Lynch, treasurer.

The largest local enterprise engaged in the manufacture of all kinds

of dental goods is the John Hood Company, which has capital of \$100,000 and employs upwards of 75 hands at its local headquarters located at 178 Tremont Street and at its factory in Hyde Park. Harry C. Bonnell is president, and Alexander R. Keltie is treasurer and secretary.

Specializing in railroad and commercial printing the A. T. Howard Company, which has capital of \$150,000, employs upwards of 100 operatives at its 9 Knapp Street plant. S. M. Sears is president, G. E. Lewis, secretary, and J. M. Howard, treasurer.

The International Glue Company has capital of \$51,900 and manufactures glues, fish meal and cod oil at its 325 Marginal Street plant. C. Thurston Peterson is treasurer and director of the enterprise.

The Jordan & Moore Press has capital of \$100,000 and employs upwards of 100 men in its printing plant at 368 Congress Street. F. I. Jordan is president, Trenchard More, treasurer, and they, with Brookes More, constitute the board of directors.

The Kistler Leather Company, which operates tanneries in Pennsylvania, West Virginia and New York state, has its headquarters at 319 A Street, Boston, where it deals in oak sole and cut leather.. The corporation has capital of \$10,000,000 and at all its units employs upwards of 800 operatives. Sedgwick Kistler is president, William O. Bentley, vice president, Bertram Urban, secretary, and Edwin F. Beck, treasurer.

The Knox Varnish Company has capital of \$50,000 and manufactures paints and varnishes at its Dorchester plant. H. P. Knox is president, M. B. Peaslee, vice president and general manager, and H. B. Morse, treasurer and secretary.

O. H. Lane, Inc., is engaged in paper ruling and binding at its factory at 596 Atlantic Avenue. I. E. Lane is president, A. E. Lane, secretary, and O. H. Lane, treasurer.

H. E. Locke & Co., Inc., manufactures cotton threads at its factory located at 109 Linden Park Street, where 125 operatives are employed. The corporation has capital of \$300,000. H. E. Locke is president, J. E. Cambria, vice president, E. P. Turney, secretary, and C. A. Kendrick, treasurer.

Locke, Stevens & Sanitas, Inc., has capital of \$250,000 and employs 35 hands in the manufacture of plumbing supplies. John H. Stevens is president, A. D. Cutler, vice president, William E. Burton, clerk, and Herbert R. Kay, treasurer.

The Lovell & Covell Company has long occupied a prominent and leading position in the confectionery industry of Boston, and employs upwards of 350 operatives at its 128 Fulton Street headquarters and at its branch plant at 116 Commercial Street. The corporation has capital of \$160,000. C. Norman Lovell is president, and N. Edwin Covell is clerk and treasurer.

The John A. Lowell Bank Note Company has capital of \$30,000 and employs upwards of sixty operatives in steel plate engraving, lithographing and printing. Payson T. Lowell is president, John A. Lowell, II, vice-president, and Alfred S. Allen, treasurer.

The Macallen Company is engaged in the manufacture of electrical insulation at its South Boston plant, where more than 300 operatives are employed. The corporation has capital of \$300,000. Thomas Allen is president, Louis McCarthy, vice president, and treasurer, and G. W. Prouty, secretary.

The D. B. Maclary & Son Company, of which David B. Maclary is

treasurer and manager and M. L. Boynton, secretary, manufactures and repairs elevators at its 129 Pearl Street plant.

Printing presses, gears, slitting and rewinding machinery constitute the major commodities manufactured by the Meisel Press Manufacturing Company, whose large plant on Dorchester Avenue affords employment to more than 200 operatives. The corporation has capital of \$170,000. C. A. Meisel is president, A. E. Meisel, secretary, and O. C. F. Meisel, treasurer. The enterprise has long ranked as one of the leading New England producers of printing presses and the field of distribution is not only nation-wide but extends to foreign lands.

For upwards of a generation the Mellins Food Company of North America has catered to the needs of the nation's babies, its infants' food products having entered the homes of countless American families. The corporation has capital of \$1,200,000 and it has its principal offices at 177 State Street, with its factory located at 41 Central Wharf. Franklin W. Doliber is president and treasurer and upwards of 150 operatives are employed.

The Frank Nason Electric Company, of which Frank W. Nason is president, G. M. Nason, secretary, and John W. Nason, treasurer, is engaged in the manufacture of electrical supplies. The concern is capitalized for \$25,000 and employs twenty-five operatives.

The National-Boston Lead Company, which has capital of \$800,000 and which employs 75 operatives, has long been ranked as one of the leading New England manufacturers of lead products. Alfred H. Brodrick is president and C. Millard Koopman, treasurer, and they, with A. F. Curtis and G. A. Coleman, constitute the board of directors.

In its plant at 1310 Columbus Avenue in the Roxbury section of Boston, the National Coat & Apron Supply Company, capitalized at \$60,000, employs more than 125 hands in the production of white duck garments. Frederick H. Meyers is president and Duane C. White is secretary, treasurer and manager of the corporation.

Machine screws, rivets, nuts, washers, studs, dowels and special screws in brass, iron, copper and zinc constitute the principal products of the New England Screw Company, which has capital of \$200,000. The corporation employs fifty operatives at its 44 Farnsworth Street plant. B. D. Holt is president and treasurer, G. J. Holt, vice president and H. L. Sanders, secretary.

The New York Mattress Company has capital of \$150,000 and employs 50 hands in the manufacture of mattresses and bedding. Emil Zofnass is president and treasurer, Jesse E. Zofnass, vice president and assistant treasurer, and J. Horan, secretary.

The Nightingale & Childs Company has its Boston headquarters at 261 Franklin Street, and its plant at 195 Albany Street, Cambridge. The corporation has capital of \$50,000 and is engaged in the production of heat and cold insulation and engineering specialties. Herbert N. Dawes is president and treasurer, Harold B. Buse, vice president and assistant treasurer, and Arthur N. Hooper, secretary. The company employs sixty men and women.

The Norwood White Company employs thirty operatives in the production of office partitions, and has capital of \$25,000. J. Wadsworth White is president, E. M. Kunkel, secretary, and William G. Norwood, treasurer.

The Pilgrim Laundry Company, which has capital of \$249,200, employs upwards of 400 workers in its 65 Allerton Street plant, in the Roxbury district, and also operates the Boston Towel Supply Company at the same location; the Unit System Laundry Company at 32 Parkman Street, Dorchester, and the Beacon Steam Laundry Company at 12 Lenox Street, Boston. Francis W. Davis is president, H. L. Rhodes, vice president, R. H. Montgomery, secretary, and C. Y. Ferris, treasurer.

The Pinkham Press, of which C. A. Pinkham is president and treasurer, M. O. Pinkham, vice president, and W. I. Thayer, secretary, has capital of \$50,000 and employs seventy hands in printing and advertising at its 286 Congress Street plant.

The Power Equipment Company, engaged in the manufacture of machinery, has capital of \$25,000. V. F. Holmes is president and treasurer, and D. W. Comins is secretary of the corporation.

Capitalized at \$100,000 and employing one hundred persons, the George H. Priggen Company, manufactures ventilating systems at its plant, located at 375 Broadway. George H. Priggen is president, Edwin R. Sparrow, secretary, and Joseph N. Leonard, treasurer.

The James H. Prince Paint Company manufactures paints at its plant at 5 Lancaster Street, and has capital of \$50,000. D. C. Arnold is president, R. H. Everett, secretary, H. F. Forster, treasurer, and G. M. Twomey, assistant treasurer.

One of the largest New England manufacturers of macaroni is the Prince Macaroni Manufacturing Company, of 207 Commercial Street, which employs 125 operatives and which has capital of \$450,000. Gaetano La Marca is president, Giuseppe Seminara, secretary, and Myron P. Lewis, treasurer.

The Frank Ridlon Company is engaged in the production of electric motors at 251 A Street and has capital of \$240,000. Upwards of seventy hands are employed by the corporation, which is officered by E. G. Young, president, A. I. Bonner, secretary, and Oliver M. Young, treasurer.

The Ripley Howland Company, of which H. B. Burnham is president and treasurer, C. G. Perry, vice president, and Linus C. Coggan, secretary, employs 25 hands in the manufacture of gold rings and diamond mountings at 333 Washington Street. The corporation has capital of \$108,000.

The Rogers Fibre Company of 210 Lincoln Street, has capital of \$2,700,000 and manufactures fibre products. Elliott Rogers is president, Louis Rogers, vice president, Eben Winthrop Freeman, clerk, L. B. Rogers, treasurer, and Eric O. Halberg, assistant treasurer.

The F. E. Rollins Company, of 69 Broad Street, is engaged in the production of external remedies and has capital of \$50,000. Ernest P. Herick is president, and Frank E. Rollins, treasurer and secretary.

A. Rosenthal & Son, owned by Aaron Rosenthal, manufactures leather novelties and employs twenty hands.

The E. F. Russ Company has its main headquarters at 287 Atlantic Avenue and its factory in Westfield, where gelatine, glue and sizing are manufactured. E. F. Russ is president and treasurer of the corporation.

The Samoset Chocolate Company of 178 Atlantic Avenue, employs more than 250 hands in the manufacture of confectionery. J. Howard Daugherty is president and Edwin F. Gibbs, secretary and treasurer.

The Savogran Company has capital of \$30,000 and employs 25 hands

in the production of cleaning powders at its plant located at 28-37 India Wharf. Clement K. Stodder is president and treasurer of the corporation.

John F. Scherber & Company, Inc., of 375 Broadway, of which John F. Scherber is president and treasurer, and Eben F. Scherber, secretary, carries on the art of lithographing.

The Spaulding-Moss Company, has long specialized in drafting room equipment and supplies at its plant at 42 Franklin Street. The corporation has capital of \$72,000 and operates branches in the Park Square Building, Boston, and at 458 Bridge Street, Springfield, employing all together upwards of 60 persons. Charles Spaulding is president, Philip B. Terry, vice president, and Archibald H. Spaulding, secretary and treasurer.

The Standard Rivet Company of 41 Lincoln Street, has capital of \$250,000 and manufactures rivets, spots and staples. D. E. Timmerman is president, C. V. Stuart, secretary, and L. B. Wallace, treasurer.

The Three Millers Corporation has its headquarters at 54 Chardon Street, and its factory at 51 Pitts Street, where confectioners', soda fountain and ice cream makers' supplies are produced. The corporation has capital of \$100,000. Charles E. Miller is president, Frank L. Miller, vice president, Lloyd W. Miller, secretary and Alfred F. DeScenza, treasurer.

The Touraine Company has capital of \$1,000,000 and employs 300 operatives in the manufacture of confectionery at its plant located at 119 Washington Street North. H. B. Duane is president and he, with H. B. Duane, Jr., and I. R. Duane, constitute the board of directors.

The Tudor Press, Inc., of 251 Causeway Street, has capital of \$100,000 and employs upwards of 60 persons in lithographing and printing. Ralph A. Wilbur is president and treasurer, and Ralph C. Weeks is secretary.

Wallets, mailers and file holders are the products of the Universal Envelope Company of 79 Sudbury Street. Maurice Winokar and Charles W. Baker are the partners in the enterprise.

The Whittemore-Wright Company, Inc., has capital of \$50,000 and is engaged in the production of oils, shellacs, waxes, and tanning and dyeing extracts. F. L. Whittemore is president, M. H. Whittemore, secretary, and Frank W. Atwood, treasurer.

The W. A. Wood Company produces oils and greases at 373 Atlantic Avenue. The partners are George W. Brown, Albert M. French and Wayland H. Lewis.

One of Boston's fast growing concerns is the Za-Rex Food Products Company, of 803 Summer Street, South Boston, which has capital of \$100,000 and employs upwards of 50 hands in the manufacture of fruit juices and syrups. Edward C. Edwards is president, Jerome E. Turrell, vice president, August Hershbaum, secretary, and Nathan P. Cutler, Jr., treasurer.

CHAPTER LI

CHELSEA

A CITY ALIVE WITH INDUSTRIAL PLANTS

The seventh largest industrial city in Metropolitan Boston is Chelsea, which houses over two hundred manufacturing establishments, whose products exceed \$35,000,000 in annual value, and whose yearly payrolls are between \$8,000,000 and \$9,000,000.

The diversity of manufactured commodities is wide, and the city's leading industries include plants engaged in producing lithography, shoes, radio sets and parts, locomotive car wheels, rubber goods, elastic webbing, wooden and paper boxes, rubber heels, wallpaper, shipbuilding, clocks, waste material, ornamental and structural iron, animal food products and chemicals.

Chelsea is located on two lines of railroads,—the Boston & Maine and the Boston & Albany—and is within one mile of the switching area of the New York, New Haven & Hartford Railroad, thus affording its manufacturers excellent transportation facilities.

The four-mile water-front of thirty-foot depth where ocean liners may berth, is considered one of the best in Boston Harbor.

A BRICK CONCERN THAT IS 152 YEARS OLD

Established in 1777, the Boston Brick Company is not only the city's most venerable industry, but it is the oldest brick concern in America that has been continuously in existence for a full century and a half.

In addition to its Chelsea plant it also operates units in New Hampshire.

The corporation has capital of \$90,000 and employs 200 operatives. Its Boston office is at 77 Summer Street. George A. Parry is president, J. Clark Bennett, treasurer, and C. H. Horne, clerk.

SAMUEL CABOT, INC.—THE CRADLE OF THE COAL TAR INDUSTRY OF AMERICA

Samuel Cabot, Inc., a name synonymous with the invention and manufacture of roofing and roofing materials in New England, traces its origin to the year 1842, when on a lonely salt marsh in Chelsea, James I. Cross set up the first coal tar boiling plant established in America, tending the fire himself a part of the time, and seeking the assistance of neighbors to watch it when he was away.

About the same year, William C. Donald, a farmer, began to burn tar for the manufacture of lamp black then used by the leather curriers of Peabody and Salem.

Two youthful geniuses, Cyrus Warren and M. D. Ross, were busily engaged a few years later in perfecting their invention of tarred paper and the tar and gravel or composition roof, but when they founded the New England Felt Roofing Works, in 1852, they could scarcely foresee that seventy-five years later half the population of the United States would live or work in buildings whose roofs were made of the same or similar

types of product to what they then manufactured. They turned to Mr. Cross for their supply of pitch and tar, but when he was unable to supply the quantity required, they began to import from abroad the materials entering into their beehive pitch and felt.

Fresh from the study of chemistry in the Massachusetts Institute of Technology, and then but recently returned from a finishing course in Zurich, Switzerland, Samuel Cabot purchased the Cross business in 1877, the founder of which had recently died, and began the work of expanding production by purchasing The William C. Donald Company, and the New England Felt Roofing Works.

Mr. Cabot taught those in his employ that his business was fundamentally of a chemical nature and that research was the mainspring of chemistry, and to this day the great enterprise now conducted under his name is operated from the laboratory. The research work which he instituted resulted in the invention of shingle stains in 1882, described by one architect as "the first improvement in exterior coloring in a century."

Following this first yield of research activity came his second invention—Sylpho-Nathol, the first American disinfectant.

It was during a summer vacation on Cape Cod, in 1880, that Mr. Cabot pondered on the wastefulness of nature in casting up eel-grass on the shore for no apparent economic purpose, and he began considering its possible use with the result that researches led to the development of Cabot's Quilt, the first insulator ever manufactured against heat, cold and sound. Because of its insulating and fire-resisting properties and resistance to decay and disintegration, it remains the best today. The laboratory work of the Cabot plant has been continued uninterruptedly and with the passing years researches led to the development and manufacture of sheep dip, in 1885; clear brick waterproofing, in 1887; heat, cold and sound insulator (Cabot's Quilt), in 1892; gypsy moth creosote, in 1898; brick and cement stains, in 1907; old Virginia white, in 1908; nut loosener and spring lubricant (Tasgon), in 1916; the process of decolorizing creosote, in 1916; the Beehive roofing tar, in 1917; Double-White paint (whiter and better than paint), in 1919; liquid gasket, adhesive and cement (Plasgon), in 1919; and the process of colloiddally dissolving pigments in hydrocarbons and other oils (the well known Collo-paking process), in 1923.

For years, thousands of chemists studied the nature of colloids, and many books were written on the subject and the idea that a true colloidal paint would be an ideal commodity was advanced by several writers. It was left to Samuel Cabot to develop a paint in which complete colloidal suspension was obtained.

The pigment is infinitely finer than the ground type. It is reduced in fact to sub-microscopical fineness. Practically the entire pigment will pass through filter paper and its penetrative power is such as to prevent cracking or peeling. It may be said with practical, if not complete scientific accuracy, to be "in solution." These new paints which have been given the name of "collopakes" seem to have all the penetrative power of the stain and the opacity of the paint and the combination, with its lasting power and wonderful depth of color, is one that the trade dreamed about, but never before attained.

The process marked an epoch in paint making and is accepted as

one of the greatest developments that the industry has known in modern times.

The lacquer manufacturer has recognized the special adaptability of the idea to his problems and a tendency toward a less viscid vehicle has been observed since the commodity came on the market.

Patents upon dozens of other processes and articles have been secured by Samuel Cabot, Inc. and in commenting upon the steady and extensive development of what is now one of the foremost manufacturing enterprises of the kind in the country a contemporary writer has said: "Taking root on the New England coast and grown to fine proportions, this industry of Samuel Cabot, Incorporated, has scattered its seed all over the world and has been the parent industry of hundreds of others whose aggregate yearly volume is in the hundreds of millions."

At its Marginal Street factory, in Chelsea, and at its Boston office, at 141 Milk Street, the corporation employs 150 operatives.

Samuel Cabot is president and clerk and March G. Bennett is treasurer, of the corporation, which has capital of \$315,300.

THE RICHARD T. GREEN COMPANY

The romance of shipbuilding as portrayed by M. Thomas Green, President and treasurer of the Richard T. Green Company at the local plant on Marginal Street, where four generations of the Green family have been engaged in shipbuilding, is of interest.

In 1853, in East Boston, the Green Shipyards were founded and because of improved conditions, the plant was moved to Chelsea, in 1900, where approximately ten acres of land on Chelsea Creek are occupied. There are twenty-six feet of water at low tide at Plant No. 1 and thirty-five feet at low tide at Plant No. 2, where ocean going steamers find berthing space. The plant is also serviced by the Boston & Albany Railroad. The normal number of employees is fifty but the plant, when busily engaged, has utilized as many as 550 men in constructing, altering and repairing wooden ships. Some of the shipbuilders in the company's employ have been with the enterprise nearly thirty-five years.

Plant No. 2 has three large buildings completely equipped for ship-work and a marine railway, 335 feet long, 68 feet wide, with a capacity of 3,500 tons. Here exceptionally large jobs are handled. At Plant No. 1 are located three marine railways and eight buildings, including blacksmith, paint, joiners, pattern, machine and boiler shops, a sawmill, rigging lofts, derricks and offices.

During the World War, the Richard T. Green Company plant was commandeered by the U. S. Government as an annex of the Charlestown Navy Yard and majored in wooden construction and in altering and repairing Government ships.

One of the outstanding contracts completed at the plant, and on which over 200 Chelsea men worked for nine consecutive months was the construction of the U. S. S. *Androscoggin*, a 260 foot revenue cutter, which cost \$250,000. In these shipyards have been built two of the largest twelve pocket mud scows in the world; twelve harbor lighters for the Port of New York; and forty lake steamers on which conversion and alteration work was completed. The steamer *Nakanda*, a 285-foot vessel of 3,500 tons displacement, was repaired by the Richard T. Green Company in the Government graving docks at the Charlestown Navy Yard during the late war

—the first repair work the United States Government allowed a private concern to perform in Government docks. One of the largest training boats afloat—the *Sturgeon Bay*, was built for the United States Training Service, at the Chelsea Shipyards.

The Richard T. Green Company and the Bethlehem Shipbuilding Corporation, Ltd., of Quincy, are the only two concerns operating shipyards at the port of Boston.

The steamship *Peary*, in which Donald MacMillan sailed to the North Pole about five years ago and which was berthed at the local shipyard, following its return, and was thoroughly overhauled by the Richard T. Green Company has recently been acquired by M. F. Bramley of Cleveland, Ohio, who sailed it to the Pacific Coast in search of a "Dream Sunken Isle." Recently the Green Company built a floating hangar designed to house a hydro-aeroplane owned by Vincent Astor. In shipping circles the company is remembered because of its work on the schooner *Alice May Davenport*, in which one of the hardest shipbuilding tasks, "the renewal of a backbone" was successfully accomplished.

During the last few months, the concern has overhauled the schooner *Josephine McQuesten*, a freighter which travels all over the world. This vessel has caused considerable comment because of its size, and the fact that its bow extended practically across Marginal Street while the repairs were being made.

M. Thomas Green is president and treasurer of the corporation, which has capital of \$150,000 preferred and \$50,000 common stock.

THE FORBES LITHOGRAPH MANUFACTURING COMPANY—THE SHOP BY THE SEA

In 1862, William H. Forbes began business in his own name, occupying a loft in the old Churchill-Watson Building, at 365 Washington Street, Boston, where, with a few employees, and comparatively little equipment, he laid the foundations of what for fifty-five years has been known as the Forbes Lithograph Manufacturing Company.

In 1868 the enterprise became a partnership under the name of W. H. Forbes & Co., and just prior to that change, it became necessary to move to larger quarters.

Three floors at 159 Washington Street, opposite the Old South Church were secured, but this location did not suffice for long, and in 1872 four floors in the building, at the corner of Devonshire and Franklin streets were leased, but the great Boston fire of that year destroyed the structure before the change was made. However, as soon as it was rebuilt, the company began occupancy and shortly after, when further expansion required more space, three floors were leased in the next building, followed soon by three more floors in the structure next to that.

In 1875 the company was incorporated under its present name—The Forbes Lithograph Manufacturing Company. It was soon evident that in the interests of efficiency and economy all operations should be conducted in one plant and in 1883 Mr. Forbes located the business at its present site, Forbes Station, in Chelsea, on the Portland Division of the Boston & Maine Railroad. The original building still constitutes a portion of the plant, though with the many additional structures that have since been required to take care of the ever-increasing expansion and growth of the business, the initial unit now houses but a small part of the manufacturing equipment.

The policy of the company has always been that of conservative yet progressive expansion and each year has seen The Forbes Lithograph Manufacturing Company add more modern equipment and when necessary, additional structures to take care of its business. This policy is responsible for its enviable position as the most outstanding industry in the lithographic field in America.

The eighteen buildings constituting the Forbes plant, containing upwards of ten acres of space, are mostly of brick and concrete mill construction and are serviced by elevators and sprinklers; are equipped with air conditioning machinery which controls the air in the printing department; with a refrigeration plant for dehumidification; with generators which produce the electrical power used, and with modern boiler facilities designed to burn either oil or pulverized coal.

To facilitate service, and afford the best quality to the trade, the company operates a paper coating plant which meets the exacting requirements of colored grades; it manufactures its own inks, and its rollers for its presses and utilizes daylight lamps for color matching after dark. The photographic apparatus, which is the largest in the world, make negatives 55 inches by 70 inches.

This beehive of industry has more than 900 motors operating over 100 presses of varied kinds—offset, stone, rotary and type. Grouped in separate departments, manned by expert workers, are the most efficient, modern embossing, dye stamping, bronzing, cutting, carton making, and folding machines. Production is supplemented by an organization of servicing departments, such as, machinists, carpenters, plumbers, steamfitters and electricians.

Large reserve stocks of paper and other materials are always at hand to take care of rush orders, which at times require many carloads of paper to be available.

The Forbes Lithograph Manufacturing Company is recognized as the first producer of theatrical posters and was the pioneer in the manufacture of artistic can labels designed and lithographed in order to sell merchandise. It was in this plant that first was conceived and developed the printed carton carrying so many of our present foodstuffs and the service has been of such excellent quality that the name of the first customer entered on the Forbes order book is still carried as an active purchaser.

The Forbes Lithograph Manufacturing Company has been noted from its inception for the consideration given its employees. The works council, an ideal innovation instituted for better employment relationship, was inaugurated in 1922 for the purpose of establishing the most favorable industrial relations upon a definite and durable basis of mutual understanding. The Forbes Mutual Relief Association is a benefit to the employees and gives them protection through the medium of life, accident compensation and group insurance. A graduate nurse and a clinic with rest rooms are maintained at the plant. A safety organization is operated and a restaurant functions at cost service. Employees who have been in the service over twenty-five years become members of the Old Guard, a gold medal group having more than ninety-five employees in this organization, some of whom have been in the service of the corporation for fifty-three years.

In 1928 a substantial extension to the plant was made, when 12,000 square feet were added to the general office and manufacturing facilities.

Whether it is a label, carton, poster, cut-out, calendar, booklet, letter-head, or any other piece of lithography or printed matter required by a customer, the concern is in a position to produce it speedily and it may be said that the romance of colored printing in the lithographic industry is embodied in the growth of the Forbes Lithograph Manufacturing Company, "The Shop by the Sea," whose reputation is unsurpassed for quality and service. It constantly carries at its Chelsea plant approximately 1,000 employees, to whom are annually paid more than \$1,500,000. Its annual sales exceed \$3,500,000.

Millions of attractive and serviceable lithographed posters, booklets, cards, calendars, window displays, labels, cartons, cutouts, letterheads and all kinds of colored printing from a sheet of stationery to a 24-sheet poster are produced.

Offices employing approximately 100 people are maintained in Chelsea, Boston, New York, Rochester, Detroit, Chicago and Philadelphia.

The phenomenal growth of this outstanding corporation has been attained under the able administration of William S. Forbes, son of the founder, who is president and treasurer of the concern. F. J. Blaney is vice president.

THE REVERE RUBBER COMPANY

In 1863, the Revere Rubber Company was established under the name of the Elastic Fabrics Company for the manufacture of rubber thread primarily. In 1883 it was reorganized, with capital of \$170,000 and for half a century it has ranked as one of the largest concerns in the city. When the United States Rubber Company was established, the Chelsea unit became a part of that great merger of rubber enterprises, and 1,200 employees specialize in the manufacture of rubber tiling and flooring of various kinds, while one large department produces Catspaw, Foster, Uskide and Springstep rubber heels, which are sold the world over.

Other moulded commodities are also manufactured in the Chelsea plant, which is one of the heavy taxpayers of the city, and one of the most substantial in the long list of local industries.

THE AUSTIN DOG BREAD & ANIMAL FOOD COMPANY

One of the oldest industries in Chelsea is the Austin Dog Bread & Animal Food Company, located on the water-front, at 124 Marginal Street, and a subsidiary of the Loose-Wiles Biscuit Company, the second largest biscuit manufacturer in the United States.

In 1864, following a serious fire in Lynn, the industry removed to Chelsea, where it manufactured ship and pilot bread and where it was originally known as C. F. Austin & Co. In 1885, regular biscuits were manufactured with dog bread as a sideline, but in 1908, when part of the plant was removed to Boston, the Chelsea division became principally noted for its dog bread and animal food.

Under the direction of the Loose-Wiles Biscuit Company, which distributes the products manufactured in Chelsea, through 150 agencies, the concern soon blossomed into one of the largest dog and fox bread concerns in the country. It employs seventy-five operatives, has an approximate annual payroll of \$80,000 and produces about \$500,000 worth of animal food a year.

The modern structures are thoroughly sprinkled and contain approx-

imately 30,000 square feet of floor space. The plant produces its own steam and generates its electric power.

It is said that the first dog bread ever manufactured in the United States was made by this concern, the process of manufacture being similar to that used in the general baking industry. Three large ovens consume approximately 100 barrels of flour a day and more than 500 pounds of cereal. Fresh meat is an important part of the ingredients. The modern equipment, consisting of flour mixers, ovens, meat boilers, conveyors, cylinder, kibbling and automatic weighing machines, etc., produce the bulk and package commodities, which are distributed throughout the United States. One-third of the product of dog bread flakes, dog bread, puppy bread and cat food is shipped in packages. Large quantities of fox bread are regularly distributed to fox farms throughout the United States.

James F. Sharkey, the local manager, has been connected with the concern for fifty-six years and there are several other employees who have been with the company for more than thirty years. All its workers are covered by group insurance and it has been the policy of the Austin Dog Bread & Animal Food Company to offer an opportunity to each employee to become a stockholder of the Loose-Wiles Biscuit Company.

THE ATWOOD & M'MANUS BOX COMPANY

The Atwood & McManus Box Company, one of the oldest wooden box concerns in the country, has its main plant, in Chelsea, and an auxiliary unit in Cambridge. The corporation has capital of \$1,650,000 and employs upwards of 500 operatives in the manufacture of boxes and packing cases.

The business was founded in 1870, and under progressive management the plants have been equipped with the most modern and improved machinery for making boxes. It makes a specialty of laboratory tests and experiments, and its products enjoy nation-wide distribution.

H. P. McManus is president, I. F. Atwood, secretary, and A. B. Atwood, treasurer.

THE LOVEWELL-HENRICI COMPANY

The Lovewell-Henrici Company, iron founders and general machinists, was established in 1872 and became incorporated in 1902. Its officers are James Connolly, treasurer and general manager; Frederick C. Lovewell, president, and Rominer Lovewell, secretary. The main plant at 928-934 Broadway is 40x80 feet in dimensions, the first floor being used as a machine shop, the second as a woodworking and pattern shop and the third for pattern storage. The foundry is a story-and-a-half building, with sheds and yards to take care of the pig and scrap iron, coke and wooden and metal flasks. It uses only the best grades of iron and its moulders and core workers are skilled mechanics.

For forty years the concern has supplied the Grant Gear Works of Quincy, with its castings. In addition to local machine jobbing and foundry work the company manufactures the Holmes & Blanchard Fertilizer machines, Shoddy Rubber Mixers, paint grinding and crushing and sifting machines. Its apparatus is installed in every large rubber plant in this country and its fertilizer machines are known all over the world. A shipment was recently made to Jerusalem. The oil presses made by the company are endorsed by the Bureau of Fisheries in its pamphlet on "The

Menhaden Industry of the Atlantic Coast." From thirty-five to forty men are employed at the local plant.

TWO OLD ESTABLISHED ENTERPRISES

For over sixty years Sawyer Crystal Bluing has been manufactured in Chelsea by the Sawyer Crystal Blue Company which is capitalized for \$180,000 and employs forty hands in caring for the largest bluing trade in the world.

The concern also manufactures ammonia.

Henry G. Chamberlain is president and treasurer and Frank Atkinson is secretary of the corporation.

In 1874 the Walker Bros., Dyeing and Bleaching Company was established. The concern was incorporated under the same name in June, 1904, with capital of \$25,000, and is engaged in the bleaching, dyeing and winding of cotton skein yarns. The plant has a capacity of 10,000 pounds per day and is equipped with nine dyeing machines. It employs upwards of fifty operatives.

Chester S. Walker is president, and Howard Walker, treasurer and secretary.

In 1878 the late George H. Wood established the Boston Rubber Company and two years later the plant of the Franklin Rubber Company of Franklin, was purchased by the concern.

THE THOMAS STRAHAN COMPANY

Chelsea products, of artistic beauty and material abundance, enter into homes of the entire nation, as well as those throughout Canada, Mexico, South America, in various parts of Europe and Asia and other sections of the world, by means of the wall paper decorations of the Thomas Strahan Company, which was established in 1885 in a small way.

"It should be possible for everyone," said Thomas Strahan, the founder, "to live in a harvest of beauty and color"—and he proceeded to make his contention a reality. His theory was that things of earthly beauty—settings such as charm the understanding—should be translated into the homes of the average man, and thus render them more comfortable and attractive.

Mr. Strahan was a progressive Boston merchant and for many years a resident of Chelsea, where he resided in one of the fine old mansions which before the great fire crowned Bellingham Hill. In 1883-84 he was the mayor of the city and was prominent in all affairs connected with the welfare and development of Chelsea. He started his first wall paper factory on Marginal Street, where, despite inadequate facilities, a large business was done, the output finding a ready sale because of its uniform high quality. Within three years it was found necessary to build a more extensive and specially adapted plant, and this was erected at the corner of Maple and Heard streets. When finished it was two stories high and extended half the length of the block to Carter Park. Another story was subsequently built, affording three floors, twenty feet in the clear, fifty feet wide and 300 feet long. Later additions included a fire-proof structure for the storage of the printing rollers, when not in use, and which number many thousands.

The Thomas Strahan Company began as a partnership and is now a close corporation controlled and managed by those who have been responsible for its growth and prosperity. The leading spirit is the general manager, William E. Dailey, who has been with the concern since the first six months of its existence. He has given to the company and its product an unsurpassed devotion for forty years. The plant employs about 100 men and women.

Robert H. Neilson is president, Edward M. Mackey, vice president, F. E. Strahan, secretary, and George A. Smith, treasurer, of the corporation.

THE COLLINS-LEE COMPANY

Outstanding among Chelsea's fish curing and smoking industries is the Collins-Lee Company, of which Wallace C. Lee is president and treasurer. The corporation occupies an entire square of more than two acres on Marginal, Highland, Suffolk and Charles streets, and is the oldest fish curing and smoking concern in New England, with more than half a century of success in the handling of fish products.

It has been located in Chelsea for thirty-eight years, and today handles about 6,000,000 pounds of fresh fish annually, with a sales valuation of approximately \$275,000, and it employs sixty-five operatives, many of whom have been with the concern for more than twenty-five years.

One of the recent additions to the plant is the Brunt Box Company, whose plant adjoins the factory of the parent concern.

The Collins-Lee Company has revolutionized the retail fish business by the use of fillets, cut from fancy haddock, and it specializes in fillets of haddock and cod, smoked fillets, kippered herring, smoked salmon, dressed haddock, fillet of sole, finnan haddie, fish hamburger and toasted sardines, all marketed under the Walrus brand.

A fleet of ten trucks is in constant service for deliveries. The fresh fish come direct from the Boston fish piers and are handled in scrupulously clean, sanitary buildings where they are emptied into vats. Modern appliances, such as electrical scalers, band saws, etc., are in use and an ingenious system of escalators and conveyers delivers the fish to the cutting department, where the fleshy part of the meat is cut for use. The fillets are individually wrapped in parchment paper, packed in tin containers, which are placed in wooden boxes, thoroughly iced and prepared for expeditious shipment to all parts of the country through the American Express Company's refrigerator cars, and in emergency, by air mail. Carload shipments leave the plant weekly.

The most interesting part in the preparation of smoked fillets, finnan haddie, etc., occurs in the modern smoke-house, which is considered to be one of the best in New England. The building is constructed of tile and brick, with sheet iron doors, and is equipped with kilns, in which the fish is given its delicious golden brown smoked color and delightful aroma. Thirty-five thousand pounds of fish can be smoked over-night.

All the bones, trimmings and entrails are ground into fish meal and shipped to Germany, where it is used to fatten hogs and cattle. Fertilizer, glue and isinglass are also by-products of the local industry.

Wallace C. Lee is president and treasurer, and the corporation has capital of \$30,000.

THE CHELSEA CLOCK COMPANY

For three decades the Chelsea Clock Company has carried the name of the city, through the medium of its product, into every port of the known world. During all this time the concern has made a specialty of ship bell clocks in many standard sizes and patterns. Clocks were made at the plant for the ship *Lexington*, recently launched at the Fore River yards, as well as for the *Leviathan* and nearly all other great monsters of the deep. Warships, merchant vessels, excursion and ferry boats, tugs, yachts—everything that floats—looks its full marine part only when it is set off with a Chelsea marine clock.

The plant is not the habitat of cheap clocks stamped out of sheet metal, assembled and placed on the market to retail for a dollar. All marine and other clocks, operating otherwise than with a pedulum, are fabricated of heavy cases of cast bronze or other metal, handsomely designed and finished, and the retail prices approximate an average of \$100 to \$150. Besides marine time-pieces the Chelsea Clock Company makes a specialty of the Chelsea Banjo Clock, which is of the pendulum type, the base being made of solid mahogany.

The foundry where its castings are made, and its cabinet shop where the cases for the mahogany banjo clocks are produced, are not in Chelsea. With these exceptions the entire manufacturing of the company is done in that city.

The heaviest processes are carried on in the basement of the local plant. Here all the metal going to make the "works" of a clock for the most part, are stamped out from sheets of brass of specified thickness. Much of the space on this floor, however, is given up to various chemical operations. For example, all the stamped out "works" of a clock are strung on wires and immersed in a solution by which they are either gold or silver plated. Most of the brass is heavily plated with gold and in the process of finishing, the most careful and exact methods are pursued to produce a perfectly working mechanism.

Air blast lacquering, assembling, escapement, timing, automatic polishing, and other departments occupy the other floors of the Chelsea plant.

While the Chelsea Clock Company has been an integral part of the city's industrial life for thirty years and while its product has been clocks of the better kind for ships and homes, it has also become famous as the producer of time measuring instruments to record the flow of electricity and water. The corporation furnishes the clocks and other time and speed recording devices for the Rolls Royce automobile and is at the present time engaged in an enlargement of its enterprise in that direction.

The company employs 200 operatives, and has capital of \$200,000. W. H. Neagle is president and secretary and Rollin B. Fisher, treasurer. The concern has its Boston office at 10 State Street.

THE RUSSELL BOX COMPANY

The Russell Box Company had its origin in the town of Saugus, where the concern was founded by a Civil War veteran, the late Charles F. Weeks. R. Y. Russell, who had been identified with the printing trade for approximately twenty-five years, learned of Mr. Weeks' desire to sell the concern he had established, and, seeing a vision of something new, as folding boxes at that time were a decided novelty, Mr. Russell acquired

the small plant in 1888 and operated it for a time in conjunction with job printing. The amount of business was very small and was carried on in a crude way as compared with modern methods, but a fair wage redounded to the proprietor and he was able, over the ten subsequent years, to educate a family of three children. The eldest son, Harlow M. Russell, graduating from the Lynn High School in 1895, at once took an active interest with his father, and in 1897 the name of the concern was changed to R. Y. Russell & Son.

Two years later other interests entered the company and remained for a short time, and a Maine corporation was formed under the name of the R. Y. Russell & Son Company. In December, 1899, the plant was moved to 42 Charles Street, Lynn, at the rear of the West Lynn Station.

The use of folding boxes had grown rapidly in the previous five years and the new plant was equipped to produce about three times as much work as had been possible at Saugus. A great deal of the work at that time was being sent to Boston, and, as it was in the days when horse drawn vehicles were in vogue, the handicap of location became pressing. In November, 1903, a plant was purchased at the foot of Gerrish Avenue, in Chelsea, new machinery was installed, and business just about doubled in a short time.

During the next five years the company developed rapidly although there were difficult problems to solve, as the company was handicapped by lack of working capital. Then the disastrous fire of April 12, 1908, swept down upon Chelsea and the R. Y. Russell & Son Company was one of the sufferers, the plant being completely wiped out. Temporary quarters were secured in the old Austin Biscuit Company factory on Marginal Street, new machinery was installed, and in July, 1908, the Russell Box Company, a Massachusetts corporation was formed.

As the temporary factory had no siding the concern was at a disadvantage and as soon as possible plans to rebuild a substantial brick building on the old siding at the foot of Gerrish Avenue was made. This was accomplished in the early part of 1912 and the business continued to increase. The building erected at that time was of brick and timber construction, 80 by 100 feet, three stories with basement, and afforded 32,000 feet of floor space.

Increasing demands for products within the next two to three years made it necessary to obtain additional space and in 1914 a storehouse of about the same size as the first building was added, which more than doubled the floor area.

War conditions overtook the company in common with all other manufacturers but the concern met with no set-back caused by the ups and downs of market prices, although the volume of business decreased for a time.

In 1921, despite generally adverse business conditions, the company continued to forge ahead, and in January, 1926, acquired additional quarters in the buildings erected by the Metz Automobile Company, near River Street, in Waltham, on the Watertown line, where it occupied as much space as was then being used at the Chelsea plant. H. C. Sooy, who for some years had been identified with the folding box industry in and around Chicago, took charge of the Waltham plant, and in three years he was able to work up an excellent volume of business.

In 1928 R. Y. Russell retired as president and Harlow M. Russell was elected to that office, holding also the position of general manager.

Waldo B. Russell is vice president and manager of the Chelsea plant, and Mrs. Susan V. Russell is treasurer of the corporation. H. C. Sooy is manager of the Waltham plant and W. J. Rice is sales manager of that unit.

The corporation has capital of \$50,000 and employs 200 operatives in Chelsea and Waltham.

The Griffin Wheel Company's Chelsea plant, employing 150 hands, casts 175 tons of car wheels every working day of the year, the product being used by almost every railroad in the world.

Other plants of this \$10,000,000 corporation are operated in Chicago, Detroit, Denver, St. Paul, Tacoma, Kansas City, Los Angeles and Council Bluffs.

THE UNITED PARLOR FURNITURE COMPANY

The United Parlor Furniture Company is not merely a concern operating a display room where designs are to be seen, but it is a veritable hive of industry employing about seventy-five men, the majority of whom live in Chelsea. The owners are Moses J. Reimer, the factory genius, who is president and secretary and M. H. Siegel, who has charge of the sales department, and is the treasurer of the corporation.

The company began business in Chelsea fifteen years ago and it has developed its manufacture of the good frame work for dining room and parlor furniture to a most exact process. A large number of new labor saving machines, several of which cost \$5,000 each have been installed within recent years.

All the lumber utilized by the concern—mainly seasoned birch and mahogany—is purchased by the carload and is subject to authoritative inspection.

While the company makes a specialty of manufacturing frames to be upholstered by other concerns, it conducts an upholstering department of its own, this and the assembling rooms occupying the greater part of the top floor of the factory.

Everlastik, Inc., was incorporated in 1914, with \$4,900,000 capital and employs 350 employees. The concern manufactures cotton and silk elastic goods and webbing, being equipped with 350 looms.

Bertram T. Martin is president, John E. Page, treasurer, and W. L. Martin, secretary. The company also owns and operates plants in Lowell and Brockton in this state, and in Bayonne, N. J., Pawtucket, R. I., and Mansfield, Ohio.

In 1916, the Maxwell Manufacturing & Superior Shoe Supply, Inc., was incorporated with \$25,000 capital and employs sixty hands in producing elastic and non-elastic cords, elastic corset laces, loops, and radio cord.

The equipment includes 340 braidiers and the officers are Samuel P. Jaffe, president, B. Epstein, secretary, and M. L. Yudin, treasurer.

THE H. T. WEST COMPANY

The H. T. West Company is owned and operated by H. T. West, and is principally a trading enterprise and distributor of oils, solvents, chemicals, pigments, waxes, rosin, turpentine, alcohol, mainly to paint, varnish,

hardware, rubber, paper, soap and other manufacturers, as well as to the innumerable consuming trades principally in New England making use of these products. In addition the concern manufactures pitches of various kinds for technical and non-technical consumers and rosin, oils and pine tars.

The company occupies about two acres of land at the end of Library Street on the Boston & Albany Railroad sidetrack, with storage yards, warehouses, storage tanks, office and laboratory, and trucking equipment to serve the business.

The officers are: president and treasurer, H. T. West; vice president, John L. Griffin; secretary, J. W. Mulcahy; assistant treasurer, H. B. Seibel. The concern has an office force of thirteen and employs twelve hands in the factory.

The founder, H. T. West, entered the business in Savannah, Ga., in 1891 and until 1913 he successively operated there and in Jacksonville, Fla.; St. Louis, Mo.; New York City; Boston; Hamburg, Germany; and again at Savannah. In 1913 he began business in Massachusetts and incorporated in 1914 with a cash capital of \$600. The first office was at 40 Central Street, Boston, and in 1915 the Chelsea property was purchased. The offices were removed from Boston to that city, in 1921.

The annual business during the past ten years has averaged somewhat in excess of \$1,000,000 per year, and the corporation has capital of \$125,000.

THE MEXICAN PETROLEUM CORPORATION

In 1916 the Mexican Petroleum Corporation purchased 24,895 acres in Chelsea and Boston, and erected thereon, in addition to office buildings and a pump house, many tanks of 55,000 barrel capacity each, and within five years thereafter was selling 2,500,000 barrels of oil annually in Boston and vicinity.

The corporation also located its car repair shops in Chelsea, where tank cars are manufactured and where its 1,200 or more railroad cars are repaired. The company's barges deliver oil for bunkers at Chelsea, and a fleet of trucks transports the commodity to customers throughout Greater Boston and New England.

The Pan American Petroleum and Transport Company, through its two subsidiaries, the Mexican Petroleum Corporation and the Mexican Petroleum Corporation of Louisiana, Inc., now operates a chain of stations at all principal Atlantic and Gulf of Mexico ports, from Portland, Me., to Galveston, Texas.

It is quite significant that at the outset of the company's operations New England was the first point of attack, because of its recognized importance in the industrial life of the United States, and the success of fuel oil in manufacturing plants, in the plant of the Jenckes Spring Company soon convinced other industrialists of its superiority over coal, and soon the Mexican Petroleum Corporation was called upon to make fuel installations in hundreds of factories in New England.

In addition to the Chelsea and Boston units, it has operated plants at Portland, Me., and Providence, R. I., since 1915, and at Fall River, since 1920.

Chadbourne & Moore, Inc., was established in 1897 and incorporated in 1918, with \$400,000 capital. It employs 100 operatives in the production

of elastic and non-elastic webbing, and operates 120 looms. H. B. Narmore is president and Everett B. Moore is secretary and treasurer.

C. SALADINO & SONS

A new invention of C. Saladino & Sons, announced in 1929, promises not only to supplant the use of gut strings for surgical and other purposes, but it bids fair to place trade in this line with Japan in jeopardy, and to revolutionize the production of strings.

The new commodity evolved by the Chelsea concern is being heralded as an article long sought by medical experts, and it is being used in exterior operation work by the leading surgeons of the United States.

The scarcity of gut strings for use in manufacturing violins and tennis racquets in 1922 and 1923 led manufacturers to seek a substitute, and C. Saladino & Sons were the first to approach the problem. Success was slow in coming, and finally they conceived the idea of using rayon silk rather than gut.

After several attempts to make a rayon silk string they abandoned the idea, for since rayon is made from wood pulp, this material would not stand up under heat or chemical solutions.

They next experimented with the finest grade of Japanese floss obtainable and after working continuously for two years they succeeded in obtaining a string that withstood all laboratory tests.

The demand for a substitute string in 1924 was so strong that they immediately introduced the silk string for tennis rackets to the trade. It was well received, and although it possessed a number of desirable features, it did not withstand climatic conditions.

The concern paid the penalty for putting the product on the market before it was perfected, for practical tests on the tennis court proved that the string would fray.

They were convinced, however, that they were on the right track and they spent another year trying to overcome this objectionable feature.

Efforts were finally rewarded, for they succeeded in perfecting a string that not only overcame the fraying objection, but defied all climatic conditions.

Not only have the Saladinos succeeded in manufacturing a string suitable for medical purposes and tennis, but they have now perfected a silk gut leader for fishing purposes.

This string has been given a severe test in order to prove its usefulness. It has been placed in boiling water and also in alcohol in order to prove that it cannot be dissolved.

A few years ago five million strands of Oriental gut were imported from Japan. Today this import has been reduced and the Saladino products have been accepted by the manufacturers of America.

Although the silk tennis string was first put on the market as a substitute for the gut type it is no longer a competitor, for these two strings satisfy two distinct markets.

Today silk strings are popular because they satisfy a need that has long existed in the tennis field for a serviceable commodity and at a moderate price. Back in 1922 and 1923 the scarcity of the raw gut material for making tennis gut strings resulted in prices that were prohibitive. The high cost of playing tennis seriously affected the growing pop-

ularity of the game. This condition prompted the Chelsea firm to search for a suitable substitute for gut.

The cost of the silk string is 66 per cent cheaper than that of genuine gut. There are sixty-six fibres to a silk string and one can readily see what a saving may be realized by their use at such a reduction in the actual cost.

It was estimated that one million tennis rackets were equipped with this string during 1929.

At the present the firm is contemplating enlarging its quarters and engineers are at work drawing plans for a new building to be erected next to the present site.

The layman marvels at the many strange operations necessary in manufacturing tennis, musical and surgical gut and is surprised to learn that these products are not made from catgut, but are manufactured from the intestines of sheep. The production of the silk string follows closely that of the gut string.

The arrangement of the buildings, the coördination of departments, the availability of materials and the method of handling, all impress the onlooker.

To follow the gut from its crude state, tied like miniature bundles of wheat, through its various processes to be evolved eventually in a beautiful finished product, ready for the tennis racket or the musical instrument, is a marvelous, almost unbelievable experience.

First, the gut is placed in a strong chemical solution and left over night to soak, a process which is repeated each day for a week. Daily the solutions are changed, growing weaker and weaker until the right condition in the gut is obtained. This is done to bring it back to its natural state as it lay in the sheep. At the end of the seventh day the gut resembles nothing so much as a mass of boiled macaroni, but considerably more puttylike in hue.

The ghastly-appearing mass is then thrown on a long table; each gut is pulled and the ends placed on sticks, ready to go through the slimming machines to be cleansed, purified and subjected to a different solution. This operation is repeated for four days. The solutions besides cleansing, give added strength to the gut.

Removed from the slimmer, it is then cut to required lengths and sized on long wooden tables. Ready for the string-makers, the strands are sorted and sized for surgical or banjo strings, for violins and 'cello strings; for bass viol, and for tennis gut. The gut is then dyed in the desired colors.

The string-makers next loop them at one end and the looper does likewise at the other. They are then spun on a hand-power machine and several strands are spun together, according to the size and requirements of the strings. Great care is taken to secure the proper tension in spinning. If spun too tight or too loose, the quality and value of the strings is impaired. All these operations are performed on the ground floor of the Saladino plant.

On the second floor of the building, the gut is placed in a huge vault, hermetically sealed when closed, and smoked over night in powerful fumes of sulphur. This procedure bleaches and toughens the product.

In the morning the gut is removed from the sulphur vault, after the interior has been cleared of its fumes by means of dampers and ventila-

tors. The strands are then strung on wooden frames, varying in length from two to twenty-one feet and are once more spun. Weather conditions and length of time in drying enter largely into spinning.

When dry, still on the frames, the gut is ready for the polishing machine. The very best quality of pumice stone imported from Italy, is used. The strings are then oiled, cut from the frames and subjected to careful inspection. All defective products are rejected, while the perfect specimens are graded. Some are coiled, tied and inserted in waxed envelopes while others are laid in full length cartons and are ready to be shipped all over the United States, Porto Rico, South America, Australia, England, Japan and elsewhere.

The company maintains a separate department devoted to the manufacture of wound strings. Gold, silver, silver-plated, aluminum and copper wires are utilized with wonderful results.

Previous to the World War the greater part of the gut-string industry was carried on in Europe. During that period it was hard to interest the American public in American-made strings, chiefly on account of the fact that it was thought climatic conditions were unfavorable to their manufacture. When the war came the industry was suspended in Europe and driven to the United States. Since then the industry has shown a steady growth. American-made strings are used all over the world and it is estimated that 75 per cent of all strings used in the world are manufactured in the United States.

The Messrs. Saladino began the manufacture of strings in Boston in 1917 and removed to Chelsea in 1919. They learned their trade in Italy. Associated in the Chelsea enterprise are Salvatore, Frank, Carmella, Michael and Joseph Saladino.

The latest addition to the equipment installed by the company to bring its plant up-to-date is the perfection of a polishing machine which eliminates much tiring work on the part of young men formerly employed in the polishing of the strings.

A. G. WALTON & CO.

A. G. Walton & Co., Inc., whose four-story factory is located on Heard and Spruce streets, operates three large shoe plants in Derry, N. H., and Lawrence and Chelsea, in this state, ranking as one of the largest producers of boys' and girls' shoes in the United States.

The officers are: Harry M. Wheeler, president; Arthur G. Walton, treasurer, and E. J. McCarthy, superintendent of factories. The company maintains an office force of more than 100, the main headquarters being in Chelsea, with branch offices in Boston, Chicago, and other cities. The corporation employs approximately 2,800 men and women and manufactures nearly one-half million pairs of shoes each year. The Chelsea plant occupies more than five acres of land and the corporation is one of the largest taxpayers in the city. The local factory is the oldest of the three units and was established in 1906, when it removed from Lynn, and approximately 1,000 operatives are employed locally.

While most shoe factories specialize in making shoes through one type of operation the Walton Shoe Company uses the McKay system, the Goodyear welt and the stitched down methods. The distribution of the Walton shoe is carried on through 20,000 retail stores, with a large staff of salesmen in the field throughout the country. The company also spe-

cializes in baseball shoes and skating boots, while one department is regularly engaged in the production of men's work shoes.

The extent of the business is recognized by the fact that the concern carries nearly one-half million pairs of shoes in stock at all times for the retail trade. Many of the employees at the local plant have been in the service of the concern for twenty years.

In addition to more than 2,500 machines engaged in producing shoes, the company cuts its own sole leather, makes its own heels and counters, operates a paper box plant and a printing department and generates its own electricity. The corporation has capital of \$246,000, and its Boston office is located at 82 Lincoln Street.

THE JOSEPH A. MAYNARD OIL CORPORATION

The Joseph A. Maynard Oil Corporation is a subsidiary of the Quincy Oil Company, and was named in honor of Joseph A. Maynard, its president, who is the owner of the Boston Brass Company and a former collector of the Port of Boston. The main office is at 56 Federal Avenue, Quincy. In addition to the water-front plant in Chelsea, the company has storage plants in Quincy and Scituate.

THE A. L. SMITH IRON WORKS

The A. L. Smith Iron Works is one of the leading companies in New England engaged in the manufacture of structural steel and ornamental iron and bronze for large buildings and is especially well-known for the excellence of its ornamental iron work. Some of the recent contracts included the Harvard Business School group of ten buildings; the Sears, Roebuck Company's plant, in Boston; the new Keith Memorial Theater; the Hartford County Court House, Hartford, Conn.; and the Syracuse Memorial Hospital, Syracuse, N. Y.; the Fogg Art Museum, at Harvard University, the new Beth Israel Hospital group, Boston; and the airplane hangars, at the East Boston airport.

The A. L. Smith Iron Works recently entered the field of radio cabinet and table manufacture and in a statement issued by an official at the time it was declared that "wrought iron is not new but of late years it has steadily shown an increase in favor, particularly when adapted to modern furniture of artistic design. Not alone is wrought iron sold for its beauty but because of its extreme strength and ruggedness as well as its amazing lightness in weight." Smithcraft has been selected as the name to identify to the trade the line made by the A. L. Smith Iron Works, and the B. H. Smith Sales Company, of 755 Boylston Street, Boston, handles the products nationally.

The corporation has capital of \$450,000 and employs upwards of 200 men. Arthur L. Smith is president and treasurer, and M. M. Rowe, secretary.

The Charlestown Knitting Mills were established in 1920, and manufacture men's and children's woolen and worsted sweater coats, bathing and athletic suits and shirts. C. Osadchuk and R. Meister are the owners of the enterprise.

One of the four factories of the Panco Rubber Company is located in Chelsea, where 250 employees are engaged in producing taps, soles and heels, in which field the concern enjoys an international reputation. It is the originator of a composition for soles. The corporation has capital

of \$1,000,000. Frank Bernstein is president, Miah Marcus, vice president, and Philip Bernstein, treasurer.

Seaver boneblack, which enters into every phonograph and wax disc made, is manufactured in immense quantities in Chelsea, and three fibre filling enterprises, whose raw materials are secured from Africa and from the depths of the ocean, are located in the city.

The famous Haskell crank case, a Chelsea invention for trucks, fire apparatus and other heavy motor apparatus, provided with Haskell removable troughs for change of engine oil and affording opportunity for inspection of operating parts, are manufactured in the city. The device permits the perfect cleansing of a crank case within a few minutes' time.

The city has assumed a leading part in the production of all parts for radio apparatus, and is the home of the William J. Murdock Company, manufacturers of the famous Murdock ear phones, and other radio apparatus. The corporation employs 200 operatives. William J. Murdock is president and Daniel R. W. Murdock, treasurer.

Four other producers of radio apparatus are included among the enterprises of Chelsea.

The city has five fish preserving and fish curing concerns, which handle tons of fish daily; seven foundries, engaged in producing iron, steel and brass castings; eight furniture manufacturers; and fifteen shoe factories.

Due to the activities of the Chelsea Chamber of Commerce fifteen new concerns located in the city in 1928, including the Standard Belt Company, United Food Products, Inc., J. Wilson Company, Eastern Wood Products, Inc., Glason Parlor Frame Company, Chelsea Wood Heel Company, Yankee Shoe Company, Young Shoe Company, All America Garment Company, Rainbow Laundry Company, Cutler Brothers, Inc., Quality Upholstering Company, Iro Safety Signal Company, Ice Utilities Company, and Pure White Laundry Company.

Each month the Chamber provides industrial realtors throughout the United States with a detailed list of local floor space available for manufacturing purposes, a policy that has brought direct results in numerous cases.

THE INTERCONTINENTAL PIPE AND MINING COMPANY

Another step towards the return of Massachusetts to its early pre-eminence in the iron industry was foreshadowed in the purchase of a thirty-acre tract of land, bordering on Chelsea Creek, where in May, 1929, ground was broken for a plant which will produce annually between 200,000 and 300,000 tons of iron pipe, and in which from 400 to 600 men will be employed.

The officers of the new corporation—The Intercontinental Pipe and Mining Company—whose officers are affiliated with the Port-a-Mousson Blast Furnace and Foundries Company of France (the second largest producers of cast iron pipe in the world), made a thorough survey of conditions in various parts of the United States, and reached their decision to locate in Chelsea because of the absence of any such competing plant in New England; because of the large potential New England market for cast iron pipe; because of the availability of skilled and dependable labor; because of the fact that this section presented the cheap-

est market in the country for scrap iron, and because of the existence at an adjacent location of the Mystic Iron Works, a pig-iron producing enterprise which is operating one of the most modern blast furnaces in the world, and from which the International Pipe and Mining Company will secure its chief supply of pig iron.

Providence, R. I., and cities in New Jersey and Delaware were in competition for the new plant, but the Chelsea location was deemed superior to any others which the company's representatives had investigated.

The parent French company is said to be one of the largest manufacturers of cast iron pipe in the world and is one of the great industrial organizations of France, employing more than 8,000 people and is engaged in operating mines, railroads, and various other properties.

The Intercontinental Pipe and Mining Company has capital of \$5,000,000 and is headed by Herbert Kennedy, as president, with Charles Francois, vice president and treasurer, the latter being the direct U. S. representative of Port-A-Mousson. Perry A. Hill is secretary, and they, with Andre Grandpierre and Marcel Paul, constitute the board of directors, of which the latter is chairman. He also holds the same position in the Port-A-Mousson Company.

The Chelsea plant represents an investment of \$3,000,000 and in addition to the manufacture of pipe, which will be cast vertically and centrifugally, water and gas fittings will be produced.

Dredging to permit access to the company's plant by ocean steamships was begun in 1929, and not only the raw materials but the manufactured products will be handled by water, as well as by rail. The plant is located on the lines of the Boston & Maine Railroad Company.

The establishment of this plant is a net gain for Chelsea to all the workers who will be employed, and involves the addition of an industry whose payroll will rank favorably with that of the largest enterprises that have located in the city within recent years.

Although plants in the United States in recent years have produced approximately \$100,000,000 of cast iron pipe annually, with a nationwide consumption considerably in excess of that figure, the records of the U. S. Department of Commerce establish the fact that no plant was located anywhere in New England. More than half of all the seventy-seven factories in the country engaged in manufacturing iron pipe are situated in Alabama and Tennessee, most of them centering in Birmingham, in the former state.

The advent of this new \$5,000,000 corporation, following closely on the heels of the creation of the Mystic Iron Works in Everett, is but added evidence that Massachusetts is forging ahead in the metal field, rather than declining, despite the fact that she has within her borders none of the raw materials upon which iron products must feed.

In 1929 the Beauty Shoe Manufacturing Company was incorporated, and is now employing about 200 operatives.

The same year the Highland Shoe Company, located in the city, and it carries seventy-five employees on its payroll.

The Kashishian Shoe Company was added to Chelsea's industries, that year, with nearly 100 workers employed, and the Permalac Process Company began business in 1929, and utilizes nearly 100 operatives in covering wood heels with a patented lacquer process.

The Texas Company erected a new oil storage plant, in Chelsea, that year, which includes repair shops and garages for its fleet of trucks, the structures costing \$500,000. The Jenney Manufacturing Company built a \$350,000 storage plant, in the city, in 1929.

The same year Ice Utilities, Inc., acquired 27,800 square feet of land, in Chelsea, upon which a large artificial ice plant was erected.

In 1929 the Salter Mills succeeded the Shirley Mills and acquired the plant of the United States Worsted Company, at Saugus, which was renovated and equipped as a wool shoddy manufacturing unit. In 1918 the promoters of the enterprise bought the plants of the F. D. Weeks Extracting Company and the Gould Manufacturing Company at Shirley, where operations were carried on under the name of the Shirley Mills until late in 1928, when the larger facilities at Saugus were bought.

The company's main office is at 67 Spruce Street, Chelsea. Abram Salter is president, and Albert Salter, treasurer, and Paul Salter, secretary.

The company's plant is equipped with seven carbonizing machines, three washers, three extractors, two dusters, twelve rag pickers, two dye tubs, lumpers, etc., and the corporation has capital of \$103,795, and employs thirty-five operatives.

The Boudette Manufacturing Company, of which C. M. Boudette is president, R. T. Boudette, secretary, and M. R. Boudette is treasurer, employs forty operatives in the manufacture of radio loud speakers.

The Avon Shoe Company has capital of \$50,000, and employs 125 operatives in the manufacture of shoes, S. I. Parker being president, E. Parker, secretary, and L. Berenberg, treasurer. The company's Boston office is at 200 Essex Street.

The Bridgeport Coach Lace Company of Massachusetts, Inc., employs 125 hands in the production of elastic and non-elastic webbing, and is capitalized for \$400,000. H. B. Naramore is president, and Everett B. Moore, treasurer.

Women's McKay novelty shoes are manufactured by the Cameo Shoe Company, which employs 150 operatives and has capital of \$50,000. Samuel Goldblatt is president. Dr. Samuel S. Pill, secretary, and Bernard Fierman, treasurer.

The Fisher Shoe Company, Inc., has capital of \$50,000 and employs 125 operatives in the production of women's McKay novelty shoes. Samuel Fisher being president, Charles Goldman, secretary, and Max Fisher, treasurer.

The Foster Rubber Company which has its main headquarters at 103 Federal Street, Boston, manufactures rubber heels, fibre soles, and arch supports at its Chelsea factory, where 25 hands are employed. Herman L. Beal is president and treasurer, and M. E. Kiley, secretary of the corporation which has capital of \$250,000.

The High Shoe Manufacturing Company employs 125 hands in the manufacture of women's McKay shoes, and is capitalized for \$42,000. Harry Bovajian is president, Michael Hagopian, vice president, Garabel Bagdasarian, secretary, and Mihran Kasparian, treasurer.

David Clayman is president, Harry Doogitch, secretary, and Abraham Krinsky, treasurer of the Kenmore Shoe Company, Inc., which is capitalized for \$185,000, and which employs 75 operatives in the production of women's McKay shoes.

Lyons & Hershensen, Inc., employs 500 men and women in the production of women's shoes, the concern having capital of \$200,000. A. Hershensen is president, and H. I. Lyons, treasurer.

The Madow Shoe Company owned by Samuel H. Isaac and Isador Madow, employs 200 hands in the manufacture of footwear.

The O K Shank Company, owned by John M. Carrecabe, Inc., employs 80 operatives in producing shoe shanks.

The Royal Electric Company employs upwards of 80 men and women in the manufacture of electrical fuse plugs, at its Chelsea and Whitman factories. The partners in the enterprise are Philip, Joseph and M. E. Riesman.

The diversification of commodities manufactured in Chelsea is marked, and besides the products previously mentioned artificial stone is made by the Adler Marble & Tile Company, the Concrete Construction Company, and by S. Slotnick, Inc.; awnings and tents by the Boston Awning Company and the Chelsea Awning Company; armatures by the Bay State Armature Service, Inc., and the Hub Armature Company; bags and leather novelties by the Well-Made Bag Company; baskets by the Anderson Basket Company and the A. Hovasse Company; men's and boy's belts by the Standard Belt Company; beverages by the Bloomberg Brothers Bottling Company and the New York Mineral Bottling Company; paper boxes by the Cardy Box Company and the Standard Box Company; carpet buffs by the New England Carpet Buffer Company; carriages and motor vehicle bodies by the Lynch Brothers Carriage Company; chairs by the Boston Chair Company and the Cannon Chair Company; chemicals by the Atlantic Carbonic Company; Messrs. Raffi & Swanson, and the United Indigo & Chemical Company, Ltd.; clothing by the Finkle Coat Manufacturing Company and the Suffolk Sport Wear Company; coal tar products by the H. T. West Company; concrete block machinery by the Star Concrete Machinery Company; confectionery by Hersom Brothers, the Globe Manufacturing Company and Vagenas Brothers; lace curtains by Clara's Curtain Shop; disinfectants by the P. A. Kiernan Insecticide Company; iron fences by the Caputo Iron Works and the W. A. Snow Iron Works, Inc.; filters and water coolers by the Boston Filter Company; fish preserving and curing by the Bay State Smoked Fish Company, the Chelsea Smoked Fish Company, the Revere Smoked Fish Company and E. H. Rock; iron and metal castings by the Acme and Anderson Foundry companies, the Connolly Steel Casting Company, the Lovewell Henrici Company and the Union Metal Works; furniture by the Boston Wood Products Corporation, the Chelsea Furniture Company, Salvatore Pizzano, the Style Parlor Frame Company, the Supreme Parlor Furniture Company, the Artisan Upholstering Company, the Quality Upholstering Company, J. Wilson, Inc., the Glason Parlor Furniture Company, the Eastern Wood Products Company and the Independent Upholstering Company; hats and caps by the Chelsea Cap Company and Harry Paul's Hat Shop; ice cream cones by the Eastern Baking Company, the United Products Company and the Old South Cone Company; insulation moulding by the Royal Insulation Moulding Company; leather tanning by Leon E. Gingras; liniment by the Tweed Liniment Company; maple syrup products by the New England Maple Syrup Company; mattresses by the Liberty Mattress Company, the New Angle Spring Bed & Mattress Company and the White Star Mattress Com-

pany, Inc.; ornamental plastic work by Agostini & Hayes, Inc.; optical frames by the Atlas Optical Manufacturing Company; wood patterns by the Chelsea Pattern Works; plumbers' supplies by the Union Metal Works; nickel plating by the Chelsea Plating Company; patches and reliners by the Standard Fabric Company and the Rubber Products Company; radio accessories by the Boudette Manufacturing Company, the Chelsea Radio Company and the Chelsea Molded Products Corporation; roofing paper by Chapman & Soden; shoe cut stock and heels by the Lynch Heel Company and J. M. Carrecabe; soap by William H. Norris & Sons; spring beds by the Beacon Spring Company; furniture springs by the Kay Manufacturing Company; store and office fixtures by the Boston Office Fixtures Company and the National Store & Office Fixtures Company; stove polish by Gilman's Stove Polish Company and the American Test Stove Polish Company; ornamental iron by the Progressive Iron Works, and umbrellas by the Lew-Ross Umbrella Company; whiting by Stickney, Tirrell & Co.; safety signals by the Iro Signal Company; rubber heels and soles by the Enterprise Rubber Heel Company; asphalt by the Simpson Brothers Corporation and James P. Haahes; concrete blocks by the Woodlawn Concrete Block Company, Inc.; auto tops by the Chelsea Auto Top Company; artificial ice by the Boston Ice Company; stove and furnace pipe-fittings by the Atlas Heating & Ventilating Company.

THE INDUSTRIES OF REVERE

In 1906 the Hy-Sil Manufacturing Company was established by David and Eli Hyman and Morris Silverman, and was incorporated the following year, with capital of \$160,000.

It is engaged in the manufacture of twist, silk and rayon ribbons and fabrics, tinsel cords and garlands, and insulated wire, the plant being equipped with eighty looms. The concern employs 150 operatives. David Hyman is president, Eli Hyman, secretary, and Morris Silverman, treasurer.

The McGlone Varnish Company, with capital of \$50,000, manufactures varnish. Henry S. Maguire is president, G. I. Jones, secretary, and Joseph E. McGlone, treasurer, of the corporation.

The plant of D. & L. Slade Company is located in Revere, and the history of this concern is treated in the chapter devoted to the industries of Boston, in which city the main office of the corporation is located.

The Suburban Gas & Electric Company, one of the Tenney chain of public utilities, is located in Revere, and has capital of \$1,564,625. It locally employs 125 men and women.

The C. M. Kimball Company is Winthrop's largest manufacturing enterprise, having capital of \$150,000, and produces metal, silver and stove polish. J. Frank Rebuck is president, H. C. Dodge, vice president; C. A. Williams, treasurer; A. B. White, clerk; F. L. Tompkins, assistant treasurer, and B. Hamburg, secretary.

The W. C. Ham Company, Inc., manufactures ice cream and confectionery and has capital of \$15,800. W. C. Ham is president and treasurer, and H. J. Lappen, secretary. The corporation employs thirty operatives.

CHAPTER LII

THE INDUSTRIAL GROWTH OF WORCESTER

THE HEART OF THE COMMONWEALTH

The industrial importance of Worcester is clearly indicated by analysis of government statistics, and the city's preeminence is attested by the fact that although it is an inland municipality, with no direct access to tide-water, nevertheless it ranks as the second city in New England, in the annual value of manufactured products, despite the fact that its population is 77,000 less than that of Providence, R. I., which enjoys water transportation.

Worcester is only exceeded by Boston in all New England in the total yearly value of manufactured commodities.

In 1927 the total value reached \$191,865,312 and it is interesting to note that between 1913 and 1927, the number of local manufacturing establishments rose from 448, in the former year to 515, in the latter while invested capital increased from \$75,474,918, in 1913 to \$174,115,467 in 1927. The value of stock and materials used advanced from \$50,453,169, in 1913, to \$96,076,461, in 1927, while the wages paid in 1913, amounting to \$19,887,759, rose to \$41,082,936, in 1927, despite the fact that in the former year there were 31,801 wage earners employed in the industrial plants of the city, as against 30,162, in 1927, figures indicative of the march of mechanical efficiency over manual operations. Most significant of all, however, is the increase in the value of products in this fifteen year period. In 1913, the commodities fabricated in the 448 establishments were valued at \$89,707,793, while in 1927, the value of locally manufactured goods was \$191,865,312.

Important gains were made in a number of lines of manufacture in the seven year period from 1921 to 1927, inclusive, the production of metal working machinery, including machine tools, rising in value from \$2,406,106, in the former year, to \$11,439,869, in 1927. The value of woolen and worsted goods increased in the same seven years from \$7,254,043, to \$10,801,032, in 1927, while the value of boot and shoe products, other than rubber, rose from \$5,097,009, in 1913, to \$7,985,096, and printing and publishing products increased from \$3,597,403, in 1913 to \$5,064,383, in 1927. Copper, tin, sheet iron and stamped ware commodities were increased in value from \$1,046,922 in 1913, to \$3,223,409, in 1927.

The aggregate value of the products made in 224 of Worcester's 515 establishments of 1927, amounted to \$115,978,347. These figures cannot be shown separately without disclosing the operations of industrial establishments which include iron and steel works, wire, rolling mill machinery, emery and other abrasive wheels, leather, leather belting, and leather specialties, carpets and rugs, envelopes, steam and electric cars, cotton goods, slaughtering and meat packing products, wood screws, and iron and steel forgings.

While Worcester is a city of diversified industries and processes some of the world's largest concerns engaged in producing the above-mentioned commodities, the metal industries, more particularly those of iron and steel, constitute the chief products of manufacture. This group includes iron and steel work, wire and wire work, metal combing machinery, including machine tools, textile machinery, foundry and machine shop products, iron and steel forgings, cutlery and tools, electrical machinery, apparatus, and supplies, copper, tin, sheet iron work, and stamped ware, and structural iron work, and in 1927, the product value in this group aggregated approximately \$80,000,000, or 41.4 per cent of the total for the city's industries, while over 13,000 of the 30,162 wage earners were employed in these metal-working plants, and to them were paid nearly \$20,000,000 in wages, or almost one-half of the total factory payrolls for that year.

THE PROWESS OF WORCESTER'S INVENTIVE GENIUSES

In the heart of the Commonwealth more than 3,000 different manufactured products are daily turned out by more than 500 establishments located in the city.

Worcester has long been recognized as typical of industrial Massachusetts, due in a great degree to the fact that from the beginning it has possessed diversified industries.

Located as it is, in the center of the Commonwealth, it boasts the largest population of any manufacturing city in the United States not served by an ocean, lake or river waterway.

No more eloquent tribute to its industrial prowess can be cited than to make the statement that Worcester produces more of the essential commodities than does any other city *in the world*, not located on a navigable or semi-navigable river, or on a stream affording a flow of water sufficient to make it a power factor, or possessing a harbor bordering an inland sea or one of the oceans.

Few industrial centers possess so many manufacturing concerns that are the largest in the United States or in the world. It houses the largest grinding wheel industry in the world; the largest corporation in the United States for the manufacture of wire, wire springs and wire novelties; the largest plant in the world devoted exclusively to the production of vacuum cleaners; one of the largest steel and wire plants in the world; one of the largest corset manufactories in the world; one of the largest wall-paper factories on the globe; one of the biggest car-building plants in the world; the largest loom-manufacturing plant in the world; the largest valentine plant, as well as the largest skate factory in the world; the biggest leather-belting mill in the world; a plant where ninety per cent of all the automobile crank-shafts made in the world are fabricated; another where seventy-five per cent of all the automobile and bicycle chassis manufactured in the world are produced; one of the largest muslin and underwear factories in the world; one of the largest carpet and rug plants in the world, and a chain of envelope factories that turn out upwards of 13,000,000 envelopes every week, or more than 2,000,000 each working day, thus making the city one of the three largest envelope-making municipalities in the world; while within its geographical confines more textile machinery and machine-tools are fabricated than in any other industrial center on the globe.

The city is also unique in that a considerable percentage of its manu-

factured products never reaches the so-called ultimate consumer in the form in which they are produced, because of the fact that they are utilized as essential equipment in a wide variety of industrial plants and in a myriad of manufactured commodities.

It may be said that Worcester's industries can best be described as "Manufacturers to Industrial America."

The gamut runs from badges and barrels, bathing suits and bed springs, belts and billiard tables, and bread and buckets, to pyjamas and photostats, pants and pins, pies and pews, pulpits and punches, tacks and tonics, toys and tools, and wire and wrenches.

THE WORCESTER SILVER MINE—ONE OF THE FIRST LOCAL ENTERPRISES

In 1754, a vein of metal, which was thought to be silver, was discovered in the northerly part of Worcester, not far from where the tracks of the Boston & Maine Railroad Company cross Mill Brook, and a company was formed to explore the deposit, furnaces and smelting-houses being erected, and a German, who had gained experience in mining operations, was secured, as superintendent. He sunk a shaft eighty feet perpendicularly, and a horizontal gallery of about the same length, which was to be intersected by another. Minute portions of silver, traces of copper and lead, much iron and an extraordinary quantity of arsenic, were uncovered, the latter emitting a disagreeable odor when struck against steel, its perfume being overpowering when the arsenic was subjected to heat. A considerable amount of money was expended in blasting, raising the fragments, in erecting buildings and installing machinery, and while the pile of slag increased, the finances of the promoters correspondingly diminished. Securing the sum of \$100 for expense money, which would enable him to journey to Philadelphia to consult with an expert in mines, whose acquaintance he claimed, the German superintendent departed with a barrel full of the products, but never returned to render a report. The proprietors destroyed the records of the enterprise, as they disliked the jibes of their neighbors, and the full story of this attempt to mine silver is lost in oblivion.

THE WORCESTER COTTON MANUFACTORY

From 1685, when Capt. John Wing built saw and grist mills, on Mill Brook, to 1789, Worcester's industries consisted of primitive factories, but in the latter year an association was formed for the purpose of manufacturing fabrics previously imported from Great Britain, and in the *Spy*, of April 30, 1789, this announcement appears:

"On Tuesday last the first piece of corduroy made at a manufactory in this town was taken from the loom."

The factory, equipped with crude machinery, stood on Mill Brook, and was situated on School Street, east of the location of the present Union Street.

On March 25, 1790, the proprietors of the Worcester Cotton Manufactory gave notice that they would not accept any more linen yarn, having a sufficient quantity on hand.

Samuel Brazer, who apparently was one of the promoters of the enterprise advertised in the *Spy*, on May 27, 1790 "goods of American manufacture to be sold at wholesale and retail, corduroys, jeans, fustians, federal rib, and cotton, for cash only. The prices are reasonable the quality

of the goods superior to those imported, which will induce all to give preference to the manufactures of their own country."

Later, the concern advertised for an overseer, for three or four apprentices and two or three journeymen weavers, but, on August 5, 1790, all who had demands against the proprietors of the Worcester Cotton Manufactory were requested to present their bills to Samuel Brazer and Daniel Waldo, Jr., from which announcement the inference seemed to be that the enterprise had not prospered. It is probable that upon the declaration of peace with England, goods could be obtained more cheaply than the Worcester manufacturers could produce them.

As early as 1784 a pottery was in operation in Worcester, being located on the road to Springfield, and some two and a half miles south "of the Meeting-House."

ISAIAH THOMAS MANUFACTURED HAND-MADE PAPER

Isaiah Thomas, founder of the *Spy*, erected, in 1793, on a dam and water privilege, in Quinsigamond Village, near the site of the present South Works of the American Steel & Wire Company, a two-vat paper mill, where hand-made paper was made by ten men and eleven girls, from 1,200 to 1,400 pounds being turned out weekly.

It was here that Zenas Crane was employed before he set out for Dalton to establish the paper business there, and the Thomas enterprise was the second of its kind in Worcester County, and the eighth in the Commonwealth. The plant was sold to Caleb and Elijah Burbank, of Sutton, February 24, 1798.

Another factory, erected shortly after 1811, below the Thomas Mill, was first used as a sickle factory by Gardner Burbank, but soon afterwards was converted into a paper mill. The Thomas mill was burned on February 24, 1827, with a loss of \$500.

Rope, watches, clocks, shoes, hats, cards, woolens, calicoes and carpets constituted the commodities manufactured in the town up to 1800.

THE GENESIS OF WORCESTER'S TEXTILE MACHINERY SUPREMACY

In 1804, Peter and Ebenezer Stowell began the operation of six looms of their own invention and construction and wove five carpets, their product being used in the State House, at Boston.

On July 19, 1809, Abel Stowell was granted a patent on wood screws, and this was followed by the issuance to him of two more patents on February 4 and July 15, 1813, for making and finishing the heads of screws.

At that period, Curtis & Goddard were engaged in building chaises, and in 1810, John Earle and Erasmus Jones set up a wool carding machine, at Lincoln Square.

Undoubtedly, William A. Wheeler was one of the oldest iron founders in Massachusetts, having begun business in Worcester, in 1812. He erected a small cupola furnace, in 1825, which was not only the first built in Worcester, but the first recorded instance of the use of such equipment in the state.

Two years later he removed to Brookfield, where he built a blast furnace, and where he remained until 1832, when he returned to Worcester. During these earlier years he manufactured machine castings, and horses

were employed to operate the requisite equipment until 1837, when steam power was substituted.

He designed the first boring-machine ever used in the town, and in 1838 made the patterns for cook and box stoves, which he manufactured, and four years later invented a furnace that burned either wood or coal, becoming the first producer of stoves and furnaces in Massachusetts. In the height of his prosperity he employed 200 men.

Wheeler engaged in the production of railroad, machine, and iron castings, as well as iron work for plows, stove fronts, aqueducts, steam and gas pipes, gearing, couplings and railroad frogs, and carried on his operations in two buildings, one 189 by 150 feet, and the other 350 by 89 feet.

In 1812, Earle & Williams were operating a machine shop, and, in 1815, they advertised that in addition to machinery for carding work, they would place in operation, about July 1, of that year, machinery for spinning that material, while Joshua Hale was also operating wool carding and spinning machines at that period. Thomas and William Stowell were the owners of machinery for dressing cloth, and William Hovey and George March were manufacturing woolen cloth. As early as 1811, Hovey had advertised his new shearing machine, and warned all persons against using it or of embodying its principles in any other similar device. The following year he built another machine, in which the shears moved across the fabric on the same principle as hand-shears, and he claimed that the device would shear 200 yards of broadcloth in a day. In 1822, Hovey built iron cylinders for carding machines, casting them in four parallel pieces.

In 1814, Jonathan Winslow was engaged in the manufacture of flyers for spinning cotton, and the same year Merrifield & Trowbridge began building cotton and woolen machinery, while Stephen R. Tenney was manufacturing wool-carding, matting, shearing and brushing machines at the same period.

On February 20, 1815, three days before Francis C. Lowell and Paul Moody were given their patent on a power loom, S. Blydenburgh and Hezekiah Healy, of Worcester, were granted a patent on a loom that would operate by steam or water power.

In the fall of 1823, William H. Howard and William Hovey, as partners, then engaged in building various types of machines, began the construction of broad power looms, and finally settled on the common Scotch looms as the best suited to the needs of that period, and placed a number in operation at the factory of the Goodell Manufacturing Company, in Millbury, and others in cotton mills in Middletown, Torrington, and Litchfield, Conn., as well as elsewhere. Dissolving partnership in 1825, the two continued to build looms on their individual accounts, Howard producing broad power cassimere and kerseymeré looms, and carding and shearing machines, at his shop in South Worcester. He marketed his looms for \$125 each, delivered at his plant, this figure including the cost of installation ready to be operated.

It should be recalled by the reader that less than sixteen years had elapsed when Howard and Hovey began their manufacture of broad power looms, from the time that steam power had been applied to the looms upon which Rev. Dr. Edmund Cartwright, of Derbyshire, England, had spent thirty thousand pounds to perfect, between his initial experiments of 1785 and 1808, when he received a grant of ten thousand pounds from Parliament for his contribution to the textile art of England.

Improvements were rapidly being made on the Cartwright loom by other inventors and it was soon brought into general use for both cotton and woolen production.

In 1826, John Goulding added his valuable contribution to the woolen machinery world by inventing the endless rolling, or American card. Previous to its appearance, the rolls, or rolling issuing from the carding machine, were limited to the breadth of the card, and the ends of the separate rolls were spliced by hand process, assisted by a machine called a "billy." Goulding dispensed with the "billy," and, by an ingenious combination of devices, obtained an endless roll, and so perfected his invention that he could employ it successfully from the moment the rolling left the dull end of the first picker until it was converted into yarn suitable to be manufactured into cloth. The device was hailed as the most important advance in the carded-wool industry of that period.

In 1828, just a little more than a century ago, a census of the industries of Worcester revealed "the large paper mill belonging to Elijah Burbank, five modern machine shops at which great quantities of machinery of various kinds are made, one small cotton factory, a lead aqueduct factory, and other works of minor note" constituted the industries of the town.

In 1828 Messrs. Rice & Miller advertised for sale Satinet looms, and two years later Messrs. Wheelock & Prentice purchased of William H. Howard the right to build his looms, upon which he had secured a patent for an improvement in the lay motion, consisting of an irregular slot in the sword of the lay through which it was moved. Today, there are many looms in operation in this country equipped with this movement, which he first produced a century ago. In 1831, Lewis Thayer and George Willey, began the local manufacture of loom-pickers, and the following year Horatio Phelps commenced the production of power looms in the shop formerly occupied by Wm. H. Howard, having purchased the right to produce and market the Howard Improved Patent Broad-loom. In 1833, the business was acquired by Messrs. Phelps & Bickford, who advertised that they were prepared to build all kinds of woolen looms of the most improved plan, to order.

In 1833, Prescott Wheelock was constructing power looms "of any description that the public might want," in a shop in the southerly end of the city, then known as "New Worcester."

Two years later, Silas Dinsmore and Fitzroy Willard formed a partnership to manufacture power-looms, but this arrangement was short-lived, as, in November, of that year Dinsmore withdrew from the firm. Willard continued the business in Court Mills, producing broad power looms to weave satinets and cassimeres, manufacturing fifty for Messrs. W. & D. D. Farnum, and installing them in their mill, in Blackstone. Most of the machinery placed in that factory was built in Worcester, as Henry Goulding constructed the carding and spinning machines for the plant.

It should be emphasized that all these manufacturers were producing nothing more than plain looms, which employed but a few harnesses, operated by cams and that they produced plain cotton or twilled fabrics. The fancy loom was an invention of a later date, and was equipped with from two to forty harnesses, the move of which was controlled by a pattern-chain, so constructed as to correspond to the different types of goods. To provide for the different colors of filling used in the fabrics, drop-boxes,

or movable boxes, were required, which also were controlled by the chain, according to the predetermined pattern.

At the present time, the cam-loom equipped with a single box, whether of two or eight harness capacity, is denominated in textile circles as a plain loom, while any loom whose mechanism is controlled by a chain, in accordance with a pre-determined pattern, is generally described as a fancy loom.

It was not until 1836 that the harnesses of any power-loom in the world had been operated in any way other than by cams, and consequently the changes of weave of which all existing looms were capable were extremely limited, and fabrics for which an intricate figure or design was required were necessarily woven, as they had been from the beginning of the weaving art, on hand-loom.

Taking into consideration the activities of the Worcester Cotton Manufactory, of 1789; the early production of hats, cards, woolens, calicoes, and carpets; the advent of the Peter and Ebenezer Stowell looms, in 1804; the wool carding machine of John Earle and Erasmus Jones, followed by their wool spinning machine; the cloth-dressing devices invented by Thomas and William Stowell; the woolen cloth manufacturing of William Hovey and George March; and the former's shearing machine; Jonathan Winslow's flyers for spinning cotton; Merrifield & Trowbridge's cotton and woolen machinery; Stephen R. Tenney's wool-carding, matting, shearing and brushing machines; Blydenburgh's and Healy's power looms of 1815; Ichabod Washburn's carding and wool spinning machines; the loom building operations of Messrs. Howard and Hovey, Messrs. Wheelock and Prentice, Horatio Phelps, Prescott Wheelock, Silas Dinsmore, Fitzroy Willard; John Goulding's American card and the loom-pickers of Lewis Thayer and George Willey, is it any wonder that the city and county of Worcester ultimately became the great center of textile machinery production?

THE TOWN BEGINS THE MANUFACTURE OF AGRICULTURAL IMPLEMENTS

History is to the effect that almost a half century was required in which to bring together the ideas of the farmer and the inventive genius of the mechanics of the United States before there was evolved a plow that was satisfactory to the agriculturists.

It was a subject that afforded as endless an opportunity of argument and controversy as the farm relief legislation of the present century.

Even the sage of Monticello, Thomas Jefferson, in the midst of his statecraft dipped his pen in ink and contributed a letter to Jonathan Williams, in 1796, in which he solemnly announced that he had discovered "the form of a mould-board of least resistance," which he had reduced to practice, and he authoritatively announced that his theory had been fully confirmed to his own satisfaction.

Nevertheless the inventors continued to wrestle with the problem, and probably nowhere were they busier than in Worcester County.

Prior to 1820 Oliver Wetherbee was producing plows of some sort, and two years later, William A. Wheeler fashioned, in Hardwick, the first iron plow turned out in the county. In 1824, a cattle-show committee in Worcester, reported that two cast-iron plows made by Mr. Wetherbee were shown at the exhibition, and that they were fast superseding those of the old type. Five years later, the Hartford Cast-Iron Plow, manu-

factured by J. & J. Nourse, in Shrewsbury, was on sale, in Worcester, and in 1833 C. Howard's cast iron plows were offered by G. T. Rice & Co., while another type of iron plow, cast in Brookfield, was on sale in Worcester. Joel Nourse removed to the town from Shrewsbury, and in 1833 offered for sale plows of the most approved construction, and of five different sizes and a year later he announced the building of "side hill plows."

In 1836 J. Nourse & Co., added the manufacture of cultivators and two years later Draper Ruggles, Joel Nourse and J. C. Mason formed the firm of Ruggles, Nourse & Mason and securing Jethro Wood's patent on cast-iron plows proceeded to manufacture types capable of turning over greensward, stubble and of operating on side-hills, as well as seed-sowers, improved expanded cultivators, and Coats' patent revolving hayrake. Later they produced Wilkes' revolving horse-rake, and in 1851 exhibited over twenty kinds of plows at the Worcester cattle-show.

At that period they occupied the Court Mills, the main building being of brick, 250 feet long, by 75 feet wide, and four stories high, and they employed 200 hands.

Worcester was then more largely engaged in the production of agricultural implements than any other city or town in the United States.

At the Crystal Palace exposition, in New York City, in 1854, the Worcester Shovel Company exhibited Kimball's patent shovels, with malleable iron sockets, and Ruggles, Nourse & Mason, who were using three tons of iron a day, showed Armsby's patent corn shovel, Perry's patent meat-cutter and a vegetable cutter, as well as double sod and sub-soil plows, and a year later they offered mowing-machines.

In 1856 the firm became Nourse, Mason & Co., and consisted of Joel Nourse, Peter Harvey and Samuel Nourse, and when this group sold the assets to Mr. Nourse a company was formed under the old name, the partners in which were Messrs. Nourse and Harvey, and Sampson & Tappan, of Boston. A shop was built at Groton Junction, near Ayer, and in 1859, 250 hands were employed, and a 60-horse-power engine provided power to the plant.

The next year the works were purchased by Oliver Ames & Company and in 1874 they were moved to Worcester, where operations were carried on until 1912, all kinds of agricultural implements, power machines, meat cutters, wheelbarrows, etc., being produced. In the latter year the company built a new plant, at South Framingham, where operations were carried on until all manufacturing of the Ames Shovel & Tool Company was centered in North Easton.

In 1857 J. T. Adriance & Co., manufactured Manny's improved mowing machine, in Worcester, and a year later Olivus Brown also produced this machine, and Maury's reaper.

J. M. C. Armsby began the local production of plows, cultivators, harrows, horse-rakes, hoes, etc., in a factory, on Central Street, 100 by 35 feet, four stories high, with two wings, one 74 feet and the other 50 feet in length, during the fifties. An engine of twenty-five-horse-power, made by the Putman Machine Company of Fitchburg, was the only piece of machinery in the plant not of Worcester manufacture.

L. G. Kniffen received a patent in December, 1861, on his Union Mower and formed the Union Mowing-Machine Company. About 1861, A. P. Richardson and A. P. Barnard organized the Buckeye Mowing Machine Company to manufacture the Ohio Buckeye machine, being licensed to

produce for New England only. When the partners separated a few years later, Richardson continued the production of the machines, and in 1865, Messrs. Whitman & Miles, of Fitchburg, purchased Richardson's interests, and five years later incorporated the Richardson Manufacturing Company and manufactured the Buckeye and Union mowing machines, the Bullard hay tedder and the Whitcomb horse-rakes. In 1868-70 the company moved to Prescott Street and later enlarged the plant which was operated for years by the concern.

THE FAMOUS WORCESTER ANTHRACITE COAL MINE

In 1823 the citizens of Worcester began to carefully examine into anthracite coal deposits, located northeast of the town, west of Plantation Street, and near the junction of the latter thoroughfare with Lincoln Street. It was reported that the coal was of the same variety as the Rhode Island, Schuylkill and Lehigh types, and was found to ignite easier and burn longer than these varieties, but not as pure as the latter, and in 1824 the Massachusetts Coal Company was incorporated. During the next two years, the Worcester coal was used in the Trumbull & Ward brewery, and in Col. Gardner Burbank's paper mill, and in 1828, an opening twelve feet wide and eight feet high had been made into the hill where the deposit was located, for a distance of about sixty feet, and at a descent of about twenty-five degrees. Here a railway was laid, the coal being carried from the mine to the place of deposit, in loads of 1,500 pounds.

In February, 1829, the Worcester Coal Company was incorporated, and the following month the Worcester Railway Company with capital of \$50,000 was formed, and was given the right to build a railway from the mine to Lake Quinsigamond and to the Blackstone Canal, but the enterprise was abandoned shortly afterward. The coal was found to be too impure for economical use, one facetious wag somewhat humorously commenting on the situation by asserting that "there was a damned sight more coal after burning than there was before."

Moses L. Morse & Co., began the local manufacture by machinery of pocket knives in 1829, these articles having been exclusively imported up to that time.

THE OSGOOD BRADLEY CAR COMPANY

The Osgood Bradley Car Company, now the second largest car manufacturing plant in the world exceeded only by the Pullman Company in Chicago, has a history extending back more than a century. In 1822, Osgood Bradley began building stages and carriages, and eleven years later he commenced the construction of passenger cars, his products being among the first built for the use of steam roads. They were simply stage coach bodies placed on flanged wheels, and the first cars were hauled over the turnpike from Bradley's shop to Boston.

In the early forties, the firm became Bradley & Rice, but from 1849 forward to 1881 when the concern became Osgood Bradley & Sons, this pioneer car builder carried on business in his own name.

Just before the Civil War, he completed a large contract for cars to be delivered to railroad promoters in Egypt, and during the struggle between the North and the South, gun carriages and caissons were turned out, together with cars. In the late sixties, he built sleeping cars that were operated between Boston and New York, and about that time he dis-

patched a car of this type to the far West, which was operated on one of the roads out of Chicago.

In 1884, Mr. Bradley died and the business passed to his sons, Henry O., and Osgood Bradley, Jr. The latter died in 1896, and Henry O. Bradley died six years later. John E. Bradley, son of Henry O., carried on production until 1909, when the Osgood Bradley Car Company was incorporated by him, of which enterprise he is today the president.

In 1910 a tract of fifty acres of land was bought at Greendale, where was constructed the most modern steel and concrete car plant in the country, containing eighteen acres of manufacturing space, and equipped with the most up-to-date machinery. About that time the steel car business began to develop and 1,200 men are today constantly employed at the plant, where the finest of steel cars are turned out. The corporation has capital of \$400,000. John E. Bradley is president, W. J. McKee, vice president, and T. H. Gillespie, is treasurer.

For a hundred and eight years this concern has made Worcester famous as the center of railroad and later electric car production, and the Osgood Bradley Car Company is not only the city's oldest continuous manufacturing unit, but it also ranks as having been under the ownership, and management of successive generations of the founder from its inception to the present time.

THE CURTIS & MARBLE MACHINE COMPANY

Albert Curtis, a native of Worcester, where he was born in 1807, engaged in the manufacture of woolen machinery, in 1833, when he was but twenty-six years of age, and two years later formed the Curtis Manufacturing Company and began the production of woolen fabrics, the concern which bore his name not becoming an incorporated body until 1880, when it had capital of \$100,000. Ten years later it was employing 150 operatives.

In 1863 Mr. Curtis entered partnership with Edwin T. Marble, a native of Sutton, to manufacture woolen machinery for finishing woolen, silk and cotton fabrics. Deciding to specialize in shearing machinery, the Curtis & Marble Machine Company has contributed more improvements to this field than have been effected in any other type of machinery used in the production of woolen goods. Mr. Marble's first patent covered the teasel gig, for raising the nap on woolen cloth.

It was Mr. Curtis who designed and built the first machines for trimming or shearing cotton cloth ever fabricated in the United States and which was responsible for doing away with the singeing or burning process formerly employed. Examining a French shearing machine then exclusively used here, equipped with one set of shears, Mr. Curtis designed machines using from two to five sets, and one of his products would treat as much fabric as twelve others under the old process.

In 1895, Mr. Marble bought his partner's interest, and, at his death, in 1910, the Curtis & Marble Machine Company was manufacturing a larger variety of textile finishing machinery than any concern in the world, covering practically every fabric, save silk. The concern became a corporation, with capital of \$75,000 in 1895.

Later the business of the Atlas Manufacturing Company of New Jersey, that of the Miller Press and Machine Company, of Woonsocket, R. I., and of the Shearing department of the Woonsocket Napping Machinery

Company, were purchased, and there is now produced at the large plant of the Curtis & Marble Machine Company, built in 1895, cloth room and packaging machinery for cotton goods, wool burring, picking and mixing machinery, and finishing machines for woolen, worsted and felt goods, carpets, plushes, silks, embroideries and rubberized fabrics.

The corporation has capital of \$175,000 and the twenty employees of 1863 have grown to 200 operatives today.

E. H. Marble is president, W. C. Marble, vice president and secretary, and C. F. Marble, treasurer.

THE AMERICAN STEEL & WIRE COMPANY

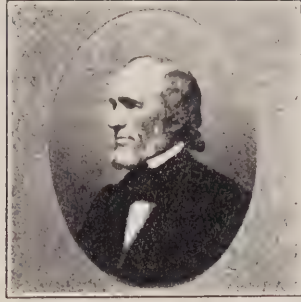
The history of the City of Worcester in respect to population, progress and prosperity would be far different from what it is in this Tercentenary year of the industrial activities if the present-day American Steel & Wire Company had never been.

True it was that Eleazer Smith began drawing wire, in Walpole, soon after the close of the Revolution, and that wire for cards was drawn by hand, in Leicester, as early as 1809, while Windsor Hatch and Charles Watson carried on their experiments in fine wire drawing, in Spencer, as early as 1812. Joseph White was operating a wire factory, in the town of West Boylston, in 1813, and the following year a wire mill on the Ware River was advertised for sale, in Barre, and a wire manufactory was being carried on in Phillipston, in 1814. Some time prior to 1815 a building, located on the old site of the Coes Wrench plant, on Leicester Street, in Worcester, was used for wire production, and by 1820 the business was well-established, in Spencer.

It was nearly a decade later, however, before Ichabod Washburn and Benjamin Godard began the manufacture of wire, in a wooden factory, at Northville, located on the second water privilege south of North Pond dam, the plant having been erected by Frederick W. Paine.

Mr. Washburn who thus became the father of the wire industry of New England had engaged in the manufacture of woolen machinery with William H. Howard as early as 1820, and a year or two later the latter purchased his partner's interest. In 1822, Mr. Washburn formed a new partnership with Mr. Godard, and they soon employed thirty men, manufacturing the first condenser and long-roll spinning jack ever produced in Worcester County, and perhaps the first made in the United States. The factory was on School Street, on the site later occupied by N. A. Lombard's plant, and near where Samuel Brazier began the production of corduroys and fustians.

The complete dependency of many leading industrial concerns in Massachusetts upon distant markets for their raw materials has in no wise circumscribed the activities of one of the outstanding manufacturing units of the Bay State—the American Steel & Wire Company,—which in 1931, will observe the centennial of the founding of the wire industry in Worcester, by Ichabod Washburn and Benjamin Godard. Nor is there any indication that this leading producer of wire is curtailing its operations in Massachusetts. On the contrary, the recent investment of two millions of dollars in plant and rolling mill extensions, at the South Works of the corporation, is proof positive that the parent concern—the United States Steel Corporation—looks with favor upon its Massachusetts investment.



ICHABOD WASHBURN
of Worcester

Founder of the Washburn
Iron Works, of that city,
later Washburn & Moen,
and today the American
Steel & Wire Company



ORIGINAL MILL BUILDING ON SITE OF THE
PRESENT NORTH WORKS OF THE AMERICAN
STEEL & WIRE COMPANY, WORCESTER

Surely an enterprise, whose annual output of manufactured products in its Worcester plants, is upwards of one hundred and thirty thousand tons; whose realty holdings in that city exceed 150 acres of land; whose local plants pay taxes to that municipality upon a valuation of \$7,500,000 on land, buildings and equipment, and whose yearly payrolls to its 4,500 employes reaches approximately \$7,500,000, may well be considered as an industrial fixture in the Heart of the Commonwealth.

It is but the reiteration of a long established fact to repeat that in no other city in the world are so many different kinds of wire and wire products manufactured as are produced in Worcester in the three local plants of the American Steel & Wire Company.

What perhaps is still more significant is the fact that the constant expansion of the local plants has been and is but a secondary consideration and is wholly incidental to the main purpose of improvement in the quality of the local products and the attainment of a higher degree of efficiency in manufacture.

The success already attained in furtherance of these two objectives, which have gone hand in hand, has been effected as the result of several causes, such as diligent and scientific inquiry, research, and investigation by alert, experienced and practical engineers, who have devoted their energies to improvement in processes and productive equipment, and to a more scientific knowledge of the inherent possibilities of the raw materials that the company fabricates into finished products in its Worcester plants. When the reader observes the wire rope attached to the elevator that transports him from the ground floor to the top of an office building, or when he crosses a suspension bridge, or sees a steam shovel or a crane at work, he is looking at a product that is employing a Worcester-made rope or cable.

As he traverses a Massachusetts road in an automobile he passes fences equipped with Worcester-made highway guard wire cables.

When he sends a telegraph message, or answers a telephone call, his communications are propelled along telegraph and telephone wires manufactured by the American Steel & Wire Company, of Worcester.

The shock absorber springs of his automobile, the springs in the railroad passenger car in which he rides, the springs in the luxurious leather chair in which he sits at his club, no doubt had their origin in the Worcester works of the American Steel & Wire Company.

The blade he uses for his daily shave is fashioned from the safety razor blade steel manufactured at the South Works, in Worcester. As he listens to the music imparted by a high-grade piano he is reminded that it flows from the wires that for eighty years have been almost exclusively produced in the United States by the American Steel & Wire Company, of Worcester, and its corporate predecessors.

And the list might be extended indefinitely to include electric power, submarine, and rubber covered wires and cables, magnet and radio wires, automobile wires and cables, annunciators and bell wires, lamp cords, copper trolley wires, aerial tramways, watch, clock, phonograph, door, and special springs, cold rolled strip steel, low and high carbon covered and flat wires, rail bonds, wire nails, and more than two thousand other steel and copper products,—all manufactured in the Worcester plants of the American Steel & Wire Company.

THE WIDE SPHERE OF INFLUENCE EXERTED BY THE CONCERN

The influence exerted by the wire mill established in Worcester, in 1831, originally designed to serve the wire needs of New England, has been far reaching. It helped other industries to grow and in supplying their ever-increasing requirements it assured its own growth and expansion. It is a statement that cannot be controverted that the history of Worcester in respect to both population and prosperity would be far different from what it is today if the industrial activities of the American Steel & Wire Company had never been carried on here.

For seventy-five years of the life of the present concern and its predecessors this great industry has led all others, as regards size, output in both tonnage and value, number of employees, extent of payroll, and as a factor in the ambitious upbuilding of the city. The tonnage handled by the New York, New Haven & Hartford Railroad Company for the Worcester units of the enterprise is greater than that of any other concern on that system.

In its three local mills, its plant in New Haven, and its warehouse in Boston, the American Steel & Wire Company ranks as one of the largest employers of labor in New England.

Time in the life of an individual or of a corporation is significant only as it marks achievement and advancement, and the results accomplished by the company in Worcester demonstrate this trite statement to its fullest extent.

The local plants have attained peaks of efficiency that have been little short of epoch-making, and the perfectly obvious fact that there are now manufactured in the Worcester plants of the concern more varieties of wire than in any other units of the United States Steel Corporation, or by any other wire-producing concern in the world, proves beyond peradventure that the enterprise occupies a leading position in the industrial life of America.

Indicative of the variety of commodities produced by it are the figures applying to the various plants. No less than sixty-three different kinds of springs are made at the South Works, while fourteen different kinds of insulated wires and cables are also manufactured there. Fifty-two different kinds of stocks and tempers in various wires are fashioned at the North Works, and sixty different types of wire rope are produced in the Worcester and New Haven plants.

ITS MODEST BEGINNINGS

In the second quarter of the nineteenth century, the hardware dealers of Worcester and vicinity imported the wire they required from England or Germany. While it is true that soon after the Revolution, Eleazer Smith commenced the drawing of wire, in Walpole; that card-wire was being drawn in the town of Leicester, as early as 1809; that a modest wire factory was operated in West Boylston, by Joseph White, in 1813; that wire was being produced in a small way in Phillipston the following year; that a wire factory was advertised for sale in Barre, in 1814; that a building on the old site of the Coes Wrench Company in New Worcester, was occupied as a wire plant, prior to 1815, and that wire was drawn in Spencer, between 1815 and 1820, it was not until 1831 that Ichabod Washburn, the founder of the present-day American Steel & Wire Company

began the manufacture of wire, in Worcester, with Benjamin Godard as a partner.

Ichabod Washburn, born in the seaport town of Kingston, on August 11, 1798, was a lineal descendant, on the maternal side, and seven generations removed, of William Bradford, who for many years was the Governor of the Plymouth Colony. Two months after his birth and that of his twin brother, Charles, their father, Capt. Ichabod Washburn, a sea captain, died of yellow fever, and at the age of nine the future Worcester wire manufacturer was apprenticed to Abner Harlow, a chaise, harness, and trunk-maker, of Duxbury. That he proved an apt pupil is evidenced by the fact that at fourteen years of age he demonstrated his skill by making a harness for his cousin. He was also employed in a Kingston cotton factory at that period. A few months later, he was hired by Mr. Snyder, an Englishman, to operate a crude loom, which was equipped with wooden cogwheels—probably one of the first power-looms built in America.

His guardian and others advised him to abandon the opportunity that came to him at that period to learn the trade of machinist, at the Almy, Brown & Slater cotton plant, in Pawtucket, R. I., on the ground that by the time he had concluded his apprenticeship "the country would be so full of factories there would be no more machinery to be built." Alas, what short-sighted vision his advisers possessed!

In the spring of 1814 the young man, then in his sixteenth year, was apprenticed to Jonathan and David Trask, of Leicester, and there he began the trade of a blacksmith, remaining with them two years, then going to the shops of Nathan Muzzy, in Leicester and Auburn, for two years more. At the age of twenty, he was graduated as a journeyman blacksmith, and worked at his trade, in Millbury, but soon began the manufacture of plows by hand on his own account, in that town, being allowed limited credit by Daniel Waldo, a hardware dealer, whose place of business was located on the site of the store now operated by Elwood Adams, Inc., on Main Street, in Worcester.

In the spring of 1819, the ever-recurring yearning for mechanical work of a higher order, led to Ichabod Washburn's employment in the Millbury Armory, where the skill demonstrated by him caused the proprietor to recommend him to William Hovey, of Worcester, who had applied for a smith capable of forging machinery, and in June or July of that year, he removed to Worcester and began in the Hovey shop on Summer Street, the manufacture of hay cutters.

A year later, he joined fortunes with William H. Howard, in the production of woolen machinery and lead pipe, and shortly afterward he purchased his partner's interest, abandoned the building of machinery, and produced lead pipe, but in 1822 when a demand arose for woolen machinery, he formed the partnership of Washburn & Godard, with Benjamin Godard as the junior member. Washburn had become acquainted with Godard while working in the Millbury Armory, where both were engaged in the machinists' trades. The junior partner was a native of Royalston, where he was born May 5, 1791.

The business prospered, and soon the School Street shop they occupied was enlarged, and the working force was increased to thirty men. Here they manufactured the first condenser and long-roll spinning-jack ever made in Worcester County.

They also experimented in the manufacture of wood screws, and visiting North Providence, R. I., conferred with Clement O., Curtis and Henry Read, three brothers, who were then producing these commodities, under a patent which they owned. An arrangement was made with them to move the screw machinery business to Worcester, and it was brought from Providence in a canal-boat, the journey occupying three days, and installed in a wooden factory on Mill Brook, erected by Frederick W. Paine, in Northville, Worcester, located on the second water privilege, south of the North Pond dam.

In 1831, Washburn & Godard, disposed of their School Street business to Messrs. March, Goulding, Smith & Hobart, and in August, of that year, began the manufacture of iron wire for wood screws and cardwire, which is today as it was in the beginning, one of the many specialties in the wire industry.

The wire was produced by Washburn & Godard, and the screws by C. Read & Co., in which firm Mr. Washburn had an interest.

THE FIRST UNIT OF THE PRESENT NORTH WORKS WAS BUILT IN 1834

Within three years, they had so far outgrown the limited water power that they were obliged to look elsewhere for a factory having greater capacity. Stephen Salisbury erected for them on Grove Street, a two story brick building 40 by 100 feet, three stories high in the center, with a sloping roof and surmounted by a cupola containing a bell, and one or more adjacent small wooden buildings.

For the purpose of providing water power, Mr. Salisbury dammed Mill Brook, thus forming what became known as Salisbury Pond.

The lease of the property, dated January 15, 1835, was to run ten years from October 1, 1834, the date of occupancy, at an annual rental of \$1,011, and as expressed, the buildings were to be devoted to "the manufacture of material of wood, metal, or leather, and for no other purpose." The lessor did not guarantee the water supply, but granted the use of the pond.

Godard continued drawing coarse wire in the Northville factory, while Washburn transferred the making of card-wire and fine wire to the new factory,—the beginning of the present North Works of the American Steel & Wire Company.

On January 30, 1835, Washburn sold to Godard, for \$2,000, his share in the Northville property, and the partnership was amicably dissolved.

ICHABOD WASHBURN INCREASES PRODUCTION

In his autobiography, Ichabod Washburn states that the first wire-machine he ever saw was one of self-acting pincers, which drew the wire through the die about a foot, then passed it back and drew it through another foot. With this crude machine, a man could draw about fifty pounds of wire per day. Washburn improved on this machine so as to draw about fifteen feet at each pass, increasing the product at least ten-fold. For this device, Mr. Washburn substituted the wire-block, which is in use at the present time, and which enabled a man to draw 2,500 pounds in a day.

In 1835, Charles Washburn, who was graduated from Brown University in the class of 1820, came to Worcester, from Harrison, Me., where he was practicing law, and formed a copartnership with his twin brother,

Ichabod, which continued until January 13, 1838. In the meantime Benjamin Godard had discontinued the manufacture of woolen machinery, and the Northville mill came into Ichabod Washburn's possession. He made a contract with Godard to draw wire for him, and wire machinery was again set up in the Northville factory. In 1840, Mr. Washburn bought the water power and property at South Worcester, which was later occupied by the Worcester Wire Company, and which is now the Central Works of the American Steel & Wire Company. Godard took charge of the mill, and retained that position until his death, in 1867. All three of his sons worked there—Delano, who afterwards became the editor of the *Boston Advertiser*; Henry, who later was at the head of an important department of the Washburn & Moen Manufacturing Company; and Dorrance, who for many years was superintendent of the South Works of the corporation. The South Worcester mill was a one-story building, about fifty feet long and thirty feet wide. Card-wire was here drawn to No. 19 size, and brought to the Grove Street plant to be finished. Coarser wire, for machinery and telegraph purposes, was also drawn at the South Worcester plant.

That the growth of the Washburn enterprise was slow during the first few years is evident from the fact that in 1840, the entire working force consisted of ten men and three boys, this statement being made on the authority of Homer J. Ball, one of the "three boys," to Arthur G. Warren, of the American Steel & Wire Company, in 1910.

In 1842 Charles Washburn again became a partner in the business, and on February 13, 1845, the old wire-mill in Northville, then used as a cotton-factory and occupied by William Crompton, was totally destroyed by fire.

By 1846 the force at the Washburn factory numbered twenty-four men and one boy, according to a statement made to Arthur G. Warren, in 1913, by William B. Bradford, then in his eighty-fourth year, who was the "boy" of 1846.

In 1847, Prouty & Earle were operating a wire-factory at Washington Square, which was later purchased by I. & C. Washburn.

THE INFLUENCE OF THE TELEGRAPH ON THE WIRE INDUSTRY

That year witnessed the dawn of a new era in the manufacture of wire. The telegraph had passed from the experimental to the technical stage and lines were being erected throughout the country as fast as capital could be secured for the ventures.

A great demand arose for what was technically termed, No. 9 Stub's gauge and it continued up to 1850. The wire was not galvanized, painting or boiling it in oil being resorted to as a preventive of oxidation. There also came at that period a heavy call for wire for fencing and for wire rope. From 1837 to 1847 all of the iron billets used by Mr. Washburn for making wire and rods were bought in Sweden, being twelve feet long, by 1 1-8 inches square. They were rolled into wire at Fall River, Troy, N. Y., and Windsor Locks, Conn., these being the plants nearest Worcester that were equipped for the work.

For a time, Ichabod Washburn journeyed to Boston, to secure each succeeding importation through the Custom House, but later he engaged a distant cousin, Henry S. Washburn, then residing in the Hub, to attend to the clearances.

THE BEGINNINGS OF THE SOUTH WORKS

In 1845, Ichabod proposed that his cousin should remove to Worcester and supervise the erection of a mill for rolling wire rods, and take charge of its operation. Ichabod agreed to back him financially, accepting as his compensation the obviously economical advantage of securing wire rods from a home source, which materials, by the terms of the contract, were to be sold to him at actual cost, while Henry Washburn's profit was to depend upon the outside sale of whatever surplus of rods remained after supplying local needs. This arrangement was put into effect, and in 1846, the first rolling mill in Worcester, located some two miles southeast of the village common, was established. The land where the mill stood was purchased by Ichabod and Charles Washburn, for \$16,000, on May 18th, of that year, and the Quinsigamond Iron and Wire Works, Henry S. Washburn, Proprietor, came into being—the nucleus of the present South Works of the American Steel & Wire Company.

The water power at Quinsigamond, a small part of which was then used by the lower paper mill remaining at that location, coupled with the opportunity for future expansion of the plant, were the primary factors that led to the purchase of the tract.

In 1847, Philip Louis Moen, then twenty-three years of age, who had married Eliza Washburn, one of Ichabod Washburn's daughters, left his father's employ, in New York City, and became a partner in the rolling mill enterprise, the name of which was changed to Washburn & Moen. Charles Washburn also became a member of the firm, which continued to operate without change of personnel until January 12, 1849, when Messrs. Moen and Charles Washburn withdrew.

On January 1, 1849, the copartnership made up of Ichabod and Charles Washburn was dissolved, and the manufacture of wire in its various branches was continued, at the Grove Street mill, by the former.

In 1850, Henry S. Washburn added the manufacture of wire to the rolling of rods, and on April 1, of the same year, Philip L. Moen became a partner with Ichabod Washburn, his father-in-law.

Early in his experience as a wire-drawer, Ichabod Washburn adopted an improved process for annealing wire, by means of which it was restored, by repeated drawing, to its original soft and pliable condition. Previously, the wire had been heated in cast-iron pots, and allowed to cool slowly. Washburn's improved process consisted in placing the small coils of wire in double air-tight iron pots.

ICHABOD WASHBURN BEGINS THE PRODUCTION OF PIANO WIRE

In 1850, at the suggestion of Jonas Chickering, of Boston, Mr. Washburn devoted his attention to the production of steel wire for piano-fortes, the manufacture of which had been previously monopolized by English houses. His experiments were successful, and the English wire was discarded for that made in Worcester. From that time on the Washburn & Moen Company was for many years the only manufacturer of music-wire in this country.

During the four-score years since Ichabod Washburn's venture in this field was commenced, this special product has been developed and per-

fect, until the type manufactured by the American Steel & Wire Company has for many years ranked as the "aristocrat of wires," and is exclusively used in the highest priced pianos of American make and in many others less costly.

Even in these days of industrial research it seems somewhat incongruous to note that a great mechanical corporation founded on roaring furnaces, mighty machines, belching cupolas, and mountains of ore, should display any interest in the delicate and cultural art of music, and yet that is precisely what the American Steel & Wire Company is doing at its South Works, where most of the piano wire used in the United States is converted from a prosaic billet into high C.

It seems that the more gigantic and efficient modern business becomes, the more the romance of the old days of Ichabod Washburn's individualism retreats to the background, and the more it opens up new avenues of romance of a limitless type—one that leads straight to the miracles of precision, knowledge, and equipment that go to make the modern age. The liaison between science and industry is found to be on its way to completeness at the South Works where one observes a world of industry being created that cannot get along without science, with science itself receiving there much of its impetus and reward from industry. Here the American Steel & Wire Company interests itself in music for purely industrial reasons, through the coöperation of science. In the physical laboratory at Quinsigamond, its director, Elmer E. Legge and the corporation's acoustic engineer, William B. White, are to be found studiously engaged in transforming sound vibrations into light vibrations that are duly recorded on photographic films, in an endeavor to secure uniform results under known and uniform conditions, which can be applied to the manufacture of piano wire. The results thus far achieved have been startling, and doubtless will lead to a precision in manufacture that will increase vastly the possibilities of interpretative artistry.

The first continuous tempering of piano wire was accomplished by Ichabod Washburn, in 1856, in the rear of his residence, on Summer Street. Early the following year, he removed the furnace to the old gymnasium on Orchard Street, and substituted oil for water in the hardening process.

The series of experiments conducted by him there led to an important invention in the process of continuous hardening and tempering. Hitherto this had been carried on only when the steel wire was in the form of a coil by subjecting it first to high heat, and then cooling it in oil or water. But the demand for piano and crinoline wire was so great that it was apparent some new and more efficient method must be evolved. Mr. Washburn patented the continuous process of hardening and tempering which, without any substantial improvement or change, has been universally adopted, rendering possible many results that could not otherwise have been reached.

He had also made considerable progress in the manufacture of card-wire, and introduced new and improved processes applying to that type of product. Swedish bars one and one-quarter inches square were rolled at Quinsigamond into wire rods of a little less than one-quarter of an inch in diameter, and carried to the factories at South Worcester and Grove Street, where they were drawn to the necessary sizes.

PARTNERSHIP CHANGES IN THE FIFTIES

On January 2, 1853, Henry S. Washburn formed a copartnership with Charles F. Washburn, and they continued rolling rods and manufacturing iron and wire under the firm-name of Henry S. Washburn & Company. the capacity of the plant at that time being about six long tons per day of ten hours.

On May 1, 1857, the partnership was dissolved, and Charles Washburn and his son, Charles F., formed the firm of Charles Washburn & Son, and continued to carry on the rolling mill, at Quinsigamond.

At that period they manufactured most of their common market wire from scrap iron piled on boards eighteen by eight inches, heated to a welding heat, and rolled into rods. The only appliances for the production of wire rods were three heating furnaces and a large train of two rolls, in which the pile of heated scrap was rolled to one and one-eighth inch billets of 100 pounds weight; and a small train of rolls three high, by which these billets were rolled into three-and-a-half by four, Stubs gauge, wire rods. Experiments in the burning of peat were made by the firm, but they did not prove satisfactory.

Henry S. Washburn, who, in 1850, had added the manufacture of wire to the rolling of rods, remained in the wire business after his retirement from the Quinsigamond plant, in 1857, and occupied a factory erected by Nathan Washburn, located near the freight depot of the Western Railroad Company, now the Boston & Albany Railroad Company.

In 1862, he retired, and removed to Boston, where he served as a member of the school board for seventeen years, two terms in the Massachusetts House of Representatives, and two terms as a member of the Senate, as well as chairman of the state central committee, of the Whig party. It was during his service in the Senate that he delivered the principal speech in favor of rescinding the vote of censure passed against Hon. Charles Sumner for his advocacy of the return of the Confederate battle flags captured by the Union forces during the Civil War.

HENRY S. WASHBURN—AUTHOR OF "THE VACANT CHAIR"

Perhaps Henry Washburn is best remembered in a national way for the stellar contribution he made to Civil War literature when he composed the famous song, "The Vacant Chair"—a poem that undoubtedly has caused more heart-throbs than any other similar production in the history of this Republic. Written by him, in November, 1861, during the first year of the Civil War, it has survived for seventy years, and its beautiful sentiments show no diminution of popularity today. His facile pen mainly paid tribute to the beauty of home life, although it frequently commemorated occasional happenings of local and national interest. It reached its apotheosis, however, in the appealing lines, "We shall meet, but we shall miss him. There will be one vacant chair."

In 1856 the Grove Street plant was designated as the Worcester Wire Works, Ichabod Washburn & Company—Ichabod Washburn and Philip M. Moen, Proprietors. Three years later the concern was employing 120 operatives, and was producing three tons of iron wire a day. In 1859, a new mill, three stories high, 80 by 40 feet, was built, while a new annealing house, 50 by 30 feet, two stories high, was erected at the South Worcester plant, where extensions were also made to the main building.

CATERING TO THE NEEDS OF DAME FASHION

The crinoline wire business commenced about 1859 and continued for ten years. Its development was made possible by the continuous hardening and tempering process invented by Mr. Washburn, which rendered it feasible to temper a cheaper grade of cast steel. This product enabled the skirt-makers to put their goods on the market, furnished with steel hoops of great toughness and elasticity, and at a price which placed the commodities within the reach of the poorest. When other fashions came into vogue, about 1870, the consumption of tempered steel in this form steadily decreased, but for several years the output of tempered crinoline wire was 1,500 tons annually, making the company the largest consumer of cast steel in the country.

As the total United States demand for crinoline wire at that period was approximately 3,000 tons per year, the Worcester plant supplied at least 50 per cent of all that was required. In 1863, the Worcester Wire Works built a cotton mill, which was operated for about ten years, where yarn sufficient to cover four tons of tempered crinoline wire per day was produced.

About 1860, Ichabod Washburn introduced continuous annealing, cleaning, and galvanizing. This was an English invention and a great improvement upon the processes previously used, being of special value at that time in the manufacture of telegraph wire.

The business of the Worcester Wire Works was hampered in the '60s because of the total destruction by fire of the Quinsigamond rolling mill plant, of Charles Washburn & Son, in November, 1862, and manufacturing operations at the Grove Street mill and the South Worcester plant were for a time confined to iron and cast steel of different grades. The era of Bessemer steel and open-hearth production had not arrived.

THE PARTNERSHIPS BECAME CORPORATIONS

On January 2, 1865, the Worcester Wire Works were changed to a corporation under the style of I. Washburn & Moen Wire Works, with capital of \$500,000 and on August 4 of the same year, the Quinsigamond Iron & Wire Works was organized. This corporation succeeded the firm of Charles Washburn & Son, which had become insolvent. Before a settlement was effected with its creditors, Ichabod Washburn purchased the property from the assignees, he having at the time a major interest in the old concern. Philip L. Moen became president, William E. Rice, treasurer and general manager, and Charles F. Washburn, secretary, of the new corporation, which had capital of \$250,000.

The average daily production of billets at the plant was then about ten tons, and of wire rods, about fifteen tons, and continuous 24-hour operations were carried on.

On November 27, 1866, the Washburn & Moen Wire Works were incorporated with capital of \$600,000.

On July 7, 1867, the mill at South Worcester was burned and the business was conducted at Grove Street until March, 1868, when the new South Worcester plant was ready for occupancy. In 1869, the company commenced the erection of most of the present buildings, at the Grove Street works.

For a year or two after its incorporation, the concern continued to

operate the South Worcester plant, but in 1870 it was dismantled, and the machinery was divided between the Grove Street and Quinsigamond Mills. The buildings were sold to S. S. Chase and L. D. Thayer, of Holyoke, who engaged in the manufacture of cotton yarn, and when they failed several years later, William E. Rice purchased the property from the Washburn & Moen Manufacturing Company, and, in 1877, organized the Worcester Wire Company, which carried on operations successfully until 1889, when the assets were purchased by the American Steel & Wire Company, since which time the South Worcester plant has been known as the Central Works.

Mr. Rice had entered the employ of Ichabod Washburn, in May, 1852, at the age of eighteen years, and was bookkeeper and general clerk until 1859, when, with Dorrance Godard, son of Benjamin Godard, he bought an insolvent wire mill, at Windsor Locks, Conn., which the two partners operated for four months until the water power failed completely. They then removed to Holyoke, purchased land and a water privilege, and erected a wire plant. On March 1, 1865, Mr. Rice bought his partner's interest, but shortly after, sold the property to a paper manufacturer.

Learning of this transfer, Ichabod Washburn purchased the wire-drawing equipment owned by Mr. Rice, and removed it to Worcester. William E. Rice then became secretary and sales manager of the I. Washburn & Moen Wire Works.

A BEDSON MILL INSTALLED AT THE GROVE STREET MILL

The increasing demand for wire in long lengths for the rapidly expanding telegraph service, as well as for other uses, could not be met at that period by wire rods in pieces weighing thirty pounds, or less, and the American producers of wire were confronted with a serious problem. The ever alert Ichabod Washburn discovered that England had solved the dilemma, and that George Bedson had invented, patented and installed a continuous rolling mill, which, together with a Siemens gas furnace, provided equipment for rolling billets weighing from 75 to 150 pounds, into No. 5 rods.

In 1867, he commissioned William E. Rice to visit Bedson, thoroughly investigate the practical performance of the continuous mill, and report on the advisability of purchasing equipment of that type and a Siemens furnace. The original pencil draft of Rice's report is preserved in the Industrial Museum of the American Steel & Wire Company, and while discriminating and keenly critical, it was conditionally favorable to the purchase and installation of a Bedson mill.

Subsequent investigation looking to the patenting in America of the English invention revealed the fact that substantially the same device had been previously patented in France by Joseph S. Levis, in 1854, and in the United States by Henry B. Comer, in 1859. It was therefore necessary to purchase the Comer and Levis interests before installing a Bedson mill, which was done, and later, Comer was engaged to come to Worcester and operate the new equipment.

THE FORMATION OF THE WASHBURN & MOEN MANUFACTURING CO.

The Quinsigamond Iron & Wire Works, under the management of William E. Rice, were then rapidly developing, and appeared to some of the officers to be the logical location for the new mill. Ichabod Washburn,

ever anxious to maintain the prestige of his Grove Street works was insistent that it be installed there. He was still the dominating power in the I. Washburn & Moen Wire Works, and by resorting to a bit of clever diplomacy he attained his object.

Mr. Rice submitted an unlooked-for proposal to surrender his interest in the I. Washburn & Moen Wire Works, and to organize a new company to purchase and operate a Bedson mill, which should be located near New York City.

This was Ichabod Washburn's opportunity, and he promptly made a counter-proposition, which included the merging of the two companies. This was agreed to, and on February 24, 1868, the Washburn & Moen Manufacturing Company was incorporated with capital of \$1,000,000, which was increased to \$1,500,000, on May 26, 1869.

Ichabod Washburn was chosen president, Philip L. Moen, vice president, William E. Rice, treasurer, Charles F. Washburn, secretary, and Charles H. Morgan, superintendent of the new corporation. The latter executive was one of the pioneer builders of the Worcester wire industry, and to his constructive ability was due no small part of the success of the Washburn & Moen Manufacturing Company during the latter part of its formative period. Mr. Morgan served as superintendent of the enterprise for twenty-three years.

Unfortunately, President Washburn was not to be permitted to see the new rolling mill placed in operation, as he died from a lingering illness on December 30, 1868, but in deference to his wishes, the Bedson equipment was installed in the Grove Street mill, the following year. Philip L. Moen succeeded Mr. Washburn as president of the new corporation.

In 1870, Treasurer Rice visited Sweden and negotiated for a supply of steel and iron in the softer grades, which rendered it possible to operate successfully the Siemens furnace and the Bedson continuous rolling mill, thus acquiring for the Washburn & Moen Manufacturing Company the distinction of being the first consumer in this country to import rolled iron and steel from Sweden. He continued as director and treasurer of the Washburn & Moen Manufacturing Company until 1875, and two years later formed the Worcester Wire Company, of which he became president.

The adoption of Bessemer steel, which occurred in 1876, created a revolution in the wire business, substituting as it did, a better and cheaper material for very many purposes. This process came into vogue at the beginning of barbed wire production. The use of Bessemer steel for this purpose alone, besides furnishing a stronger wire than could be made from Swedish iron, representing a saving of at least \$4,500,000 annually to the farmers of the country.

THE COMPANY'S IMPORTANT PART IN THE BARBED WIRE FIELD

The history of the Washburn & Moen Manufacturing Company in the field of barbed-wire production constitutes one of the romantic chapters in American industry. The archives of the industrial museum of the American Steel & Wire Company at Worcester, fairly reek with data, models, pictures and literature pertaining to the development and growth of fencing material equipped with barbs, spurs, thorns, or prickers.

On April 2, 1867, a patent was granted Alphonso Dabb, of Elizabeth-

port, N. J., on a "picketed wrought iron strip" for a wall or a fence—apparently the earliest suggestion presented to the U. S. Patent Office of a material armed with sharp, projecting points designed to render it a more effective barrier.

On June 2, of the same year, Lucien B. Smith, of Kent, Ohio, received the earliest U. S. patent covering wire fencing possessing projecting points or barbs. William D. Hunt, of Scott, N. Y., was granted a patent on July 23, 1867, for a wire fence equipped with spur wheels, and later he was awarded priority of invention over Smith, in a legal action, thus being officially recognized as being the first in the field to equip a fence wire with spurs or barbs.

On February 11, 1868, Michael Kelly, of New York, was awarded a patent on his "Thorny Fence," a wire product armed with perforated, elongated-diamond shaped two-point flat barbs, and on the following November 11, another on round wire thorns thrust through holes in flat wire, these two grants being numbered among the valuable basic patents. Lyman P. Judson, of Rose, N. Y., followed, on August 15, 1871, with a patent on "barbed iron strip fence," which was not a success, and on May 13, 1873, Henry M. Rose, of Waterman Station, Ill., received a patent on "wooden strip with metallic points." On October 27, 1873, Joseph F. Glidden, of De Kalb, Ill., filed an application for a barbed wire patent, an essential feature of the specification being a novel method of holding the spur-wires in position.

Glidden was a farmer, and began the manufacture of his barbed wire in a small way, that fall. He first made a few rods of fencing and used it on his farm. The barbs were formed by bending around a mandril and were slipped upon one wire of the fence. The second wire was then intertwisted with the first, this process locking the barbs in place and preventing lateral as well as rotary motion. The fencing was made in sixteen-foot lengths, and as there then existed no means for coiling it on spools for transportation, it was carried to the point where it was to be erected, and enough of the sixteen-foot sections were spliced together to provide a fence of the desired length.

The first piece actually sold for use was in the spring of 1874. Three boys and two men were able to make 50 pounds per day. In June, 1874, it was arranged to do the twisting by horse-power, and this increased the daily product of three boys and two men to 150 pounds.

In the latter part of 1874 a rude-hand-machine was devised for twisting the barb upon the main wire and spooling the product, which was subsequently unwound and twisted with a second wire and then spooled again. By the use of improved machinery, one man could produce, in 1889, 2,000 pounds, or over five and a half miles, in ten hours.

Glidden's claim was challenged by Jacob Haish, of De Kalb, and, due to interference proceedings instituted July 28, 1874, and also to the time required for the necessary amendments to the application, the patent was delayed until November 24, 1874, when, following the interference decision awarded in Glidden's favor on the previous October 24, he was granted a patent.

Meanwhile, three barbed wire patents of later application had been granted to Haish and one to Glidden.

On February 24, 1874, Isaac L. Ellwood, of De Kalb, was granted a

patent on a "barbed fence," the design being similar to the type for which Haish had received a patent on February 17, a week earlier.

On August 11, 1874, Charles Kennedy, of Hinckley, Ill., was granted a patent for a barb to be attached to plain wires, mainly on fencing already erected, and that year Kennedy purchased the Hunt patent.

The earliest invention covered by the Glidden patent No. 157,124, issued November 24, 1874, for which he had filed application on October 27, 1873, embodied a radical improvement in barbed wire construction, and was the most practical form conceived up to that time. It not only proved more popular than any other style, but for a half-century afterward it held and it still occupies a leading place. For many years its nearest ranking competition was Haish's famous "S" barbed wire, which proved a worthy rival.

In July, 1874, Glidden sold to Isaac L. Ellwood, a hardware dealer of De Kalb, a one-half interest in patent 157,124 for \$130, plus \$135 to cover one-half of the incidental expenses to that date—a total of \$265. They formed a partnership under the firm name of the Barb Fence Company, for the manufacture and sale of barbed wire fencing, established a factory in De Kalb, purchased an interest in the Hunt, Smith and Kennedy patents, and tried, without success, to buy the Kelly patents.

About the same time, Haish began the manufacture of his fencing.

CHARLES F. WASHBURN ENTERS THE PICTURE

Secretary Charles F. Washburn, of the Washburn & Moen Manufacturing Company was a man of vision, a confirmed optimist, and never discouraged by rebuffs or reverses, so confident was he of ultimate success. It was upon his urgent advice that the Worcester corporation interested itself in the barbed-wire war in the west. He believed that the introduction of the product would not only solve the fencing problem of the farmers of the middle states, but of the agriculturists of all sections of the country.

His genial, gentlemanly and conciliatory qualifications rendered him the man to cope with what was perhaps the most ticklish situation with which the wire industry of America has ever been called upon to cope in a century of existence, and he was delegated by his associates to investigate the facts and conditions, with a view to acquiring an active interest for the Worcester concern in this then new development in the wire field.

In March, 1876, he went to Chicago, where he met Jacob Haish, who invited him to visit his factory at De Kalb. There Mr. Washburn witnessed the production of the Haish barbed wire, and he sounded the owner as to whether or not he would sell his patent rights and equipment.

Mr. Haish was willing to sell—for a consideration—and named \$200,000 as his price. Paying Mr. Haish the compliment of believing him equally serious with himself, Mr. Washburn promptly withdrew and turned to Glidden and Ellwood. Many years later Haish stated that, if Washburn had been a typical Yankee and had offered him \$25,000, he probably would have accepted it.

Mr. Washburn was shown the equipment and product of the Barb Fence Company, inquired into the conditions and prospects of the business, was favorably impressed and learned that Glidden was willing to retire—for a consideration. Negotiations were begun in earnest, and in May, of that year, the Washburn & Moen Manufacturing Company pur-



VIEW OF MAIN YARD, GROVE STREET WORKS, WASHBURN & MOEN MFG. CO., WORCESTER, 1882, NOW THE YARD OF THE NORTH WORKS, AMERICAN STEEL & WIRE COMPANY, WORCESTER



YARD OF THE NORTH WORKS, AMERICAN STEEL & WIRE COMPANY, WORCESTER, 1927
 DELINEATING THE DIFFERENCE IN THE METHODS OF INDUSTRIAL TRANSPORTATION IN FORTY-FIVE YEARS.

chased his remaining one-half interest in his patents, and in the assets of the Barb Fence Company for \$60,000, in cash and notes, and with an agreement to pay a quarter of a cent per pound on all wire manufactured by the Worcester concern, or by any person or corporation under its authority as licensee, or otherwise, or in the manufacture of which Washburn & Moen might be interested, and which should be sold at fifteen cents or more per pound, the royalty on all wire selling at less than the fifteen-cent figure to be correspondingly reduced.

Charles F. Washburn and I. L. Ellwood formed the firm of I. L. Ellwood & Company to succeed the Barb Fence Company. The De Kalb factory was enlarged, and the western market was assigned to the new concern, while the eastern and southern trade was to be supplied from Worcester by the Washburn & Moen Manufacturing Company. The entire control of all of Glidden's existing patents, and any he might be granted in the future, and of the basic patents awarded to Hunt, Smith and Kennedy were acquired, and when Ellwood later purchased the original and reissued patents given Kelly, a practical monopoly of the barbed wire business of the United States was effected. The two concerns extended their patent protection to England and the European Continent that year and in 1877. They also became possessed of the legal title to the invention of barbed wire, although this phase was bitterly and persistently contended in the courts by Haish, but never with more than temporary success.

Realizing their value, I. L. Ellwood & Company made earnest and repeated efforts to purchase the Haish patents, or to obtain his coöperation, and eventually both the grants and a limited degree of assistance from him were secured.

THE TWO CONCERNS CONQUER SALES RESISTANCE

The troubles of the Washburn & Moen Manufacturing Company and of I. L. Ellwood & Company were not confined, however, to difficulties with inventors and infringers. Strong prejudices had to be overcome to introduce barbed wire on the market. Many hardware dealers would not have it in their stores. The public, too, had to be educated. A length of barbed wire, with two barbs upon it, was shown to two men in Texas; one guessed it was a model of a fence, the barbs being the posts, and another thought it was a bit for a horse. A skeptical farmer said he didn't believe it amounted to much; that he had a bull, "Old Jim," who would go through anything and he guessed he wouldn't stop for barbed wire. His field was fenced; "Old Jim" shook his head, elevated his tail and started for the fence. The farmer was converted—and so was "Jim."

Once introduced the commodity grew rapidly in favor, and became a necessity. It was strong, durable, cheap, easily transported, and an absolute barrier against man and beast. Infringers began to spring up, and litigation followed. No stronger or more persistent efforts were ever made to break down the rights to patents than were directed against those applying to barbed wire. Thousands of pages of testimony were taken upon alleged cases of prior use.

The defence relied upon establishing the alleged cases of prior use, and insisted strongly that there was no invention in arming a wire with pricking spurs. The United States Circuit Court for the Northern District of Illinois, in December, 1880, sustained the patents, and gave the Wash-

burn & Moen Manufacturing Company, and its associate, I. L. Ellwood & Company, control of the business. Licenses were issued to most of the infringers and to protect themselves and their licensees, the Washburn & Moen Manufacturing Company purchased upward of 250 patents upon barbed wire and barbed wire machinery.

With a view to stabilizing the rapidly developing industry, and to minimize the difficulties arising from possible infringement litigation, a general ruling was announced that patents owned or controlled by applicants for license to manufacture should be transferred to the licensors as part of the terms of license.

The refusal of certain inventors and manufacturers of barbed wire either to sell patent rights, or to acknowledge the supremacy of Washburn & Moen and I. L. Ellwood & Company, and their determined persistence in the stoutly claimed right to independent manufacture and sale, resulted in the appearance on the market throughout the Middle West and Southwest of quantities of so-called "moonshine" wire.

In the subsequent litigation, the most determined and the ablest opponent of Washburn & Moen and Ellwood, until the entrance of John W. Gates in the early '80s, was Jacob Haish, who was encouraged and supported by an ardent group of interested farmers and others, scattered throughout the Middle West.

After nearly two decades of incessant struggle in the Federal courts, marked by findings and reversals in original and appellate tribunals respectively, the United States Supreme Court, on February 29, 1892, rendered a final decision establishing the claim of Washburn & Moen and Ellwood over all competitors.

An occasional barbed wire case was heard later in the courts, mainly for the purpose of suppressing "moonshiners," but the famous old-time controversies which held the attention of manufacturers, dealers and farmers throughout the country for so many years, were practically settled by the decision of the Court of last resort.

In the main lobby of the Patent Office in Washington is an interesting display of United States letters patent granted for inventions which have been epoch-making in their resulting benefits to mankind. It is significant that the single barbed wire patent given a place in this industrial "hall of fame" is No. 157,124, granted to Joseph F. Glidden on November 24, 1874.

Charles F. Washburn's outstanding service to the Washburn & Moen Manufacturing Company, in which he was a director and an officer from its incorporation until his death, on July 20, 1893, was his successful conduct of the negotiations and the establishment of its policy relating to barbed wire, as well as his skillful care of its interests during the famous legal controversies over the patent rights.

THE USE OF AUTOMATIC MACHINERY DECREASED THE PRICE OF THE COMMODITY

The quantity of barbed wire consumed in this country increased from five tons, in 1874, to a probable output of 150,000 tons—over 850,000 miles—by 1888. Of this amount, the Washburn & Moen Manufacturing Company made, during that period, about 18,000 tons, or over 100,000 miles. The capacity of the Worcester works was 75 tons per day of ten hours, or 426 miles. The cost to the consumer during that time was re-

duced from 18 cents per pound to less than 5 cents, the decrease being due largely to the introduction of automatic machinery.

Perhaps the best evidence of the importance of the production of barbed wire by the Washburn & Moen Manufacturing Company is to be found in the figures applying to the number of employees. In 1875, the year before Charles F. Washburn began his negotiations in the west—700 hands were employed at the Worcester plants. In 1880 the total reached 2,100 operatives, and by 1889 there were 3,000 names on the company's payrolls.

The buildings at that time covered twenty-five acres of ground, and the machinery required engines of 7,200 horse-power.

About the time that barbed wire began to be manufactured the company became the owners of patents upon bale ties—a wire substitute for wood and rope previously used. There were, in 1889, probably 10,000 tons used annually for binding hay in the United States.

Wire was applied to the bales with so much greater ease than wood or rope, that a saving of fifty cents per ton, at a low estimate, was effected in pressing hay when wire ties were used. Millions of dollars were saved annually by the introduction of wire ties, all of which was effected in the twelve or fourteen years preceding 1889.

COPPER WIRE COMES INTO ITS OWN

Beginning about 1884 copper wire took a prominent place among the products of the company, as it was largely substituted for iron, particularly in long distance telephoning and electric lighting. Copper had always been preferred to iron for electric purposes by reason of its greater conductivity, but previous to the introduction of hard-drawn copper wire it did not possess the requisite strength. By the process evolved by the Worcester concern a copper wire of sufficient strength could be produced that was much lighter than iron, and of largely increased conductivity.

In January, 1884, there were probably not more than 100 or 200 miles of hard-drawn copper wire in use in this country. In 1889 there were at least 50,000 miles, representing about 4,200 tons of metal, in operation by the various telegraph and telephone companies, the average weight per mile being about 170 pounds. The larger sizes of copper wire were used in connection with electric railways.

Among the specialties introduced by the company were wire rope; galvanized steel wire cable for suspension bridges; phosphor-bronze and copper wire rope; transmission and standing rope; galvanized wire seizing; hoisting rope; tiller rope; switch rope; copper, iron and tinned sash cord wire; clotheslines and picture-cords; galvanized iron wire rope for ships' rigging; and galvanized crucible cast-steel wire rope for yachts' rigging. The rapid introduction of cable railways about 1889 created another demand for wire rope.

The manufacture of wire nails was another branch of production and the introduction of two articles of manufacture—barbed wire and wire nails—within the fifteen years preceding 1889 created a new demand for wire, amounting to at least 275,000 tons per annum, all made possible by the use of Bessemer steel.

While the process of drawing wire is, in principle, the same as was practiced eighty years ago, many improvements have been made leading to a largely increased relative product. Great advances have been made

in certain of the mechanical processes, particularly in the rolling of wire rods.

The demand for wire and the purposes for which it was used increased rapidly as indicated by the Worcester company's output of 245 tons daily in 1889 and the manufacture of 418 different kinds of wire.

THE COMPANY ESTABLISHES PLANTS IN THE WEST

The steadily increasing demand in the west for various kinds of wire and wire products led The Washburn & Moen Company, in 1890, to the belief that advantage would accrue from establishing a manufacturing plant in that section of the country, that would provide quicker service as well as avoid heavy transportation charges on raw material from, and on finished products to the west. The year 1891 saw in successful operation a large and modern factory located on the shores of Lake Michigan, at Waukegan, Illinois. Almost totally destroyed by fire in November, 1899, the plant was rebuilt and enlarged by the American Steel & Wire Company.

Meanwhile, the rapid extension of cable street railways had resulted in a large and increasing demand for steel wire rope in long lengths. Andrew S. Hallidie, the inventor of the cable railway, had established the California Wire Works, at San Francisco, for the manufacture of wire and wire rope. In the early '90s, this plant was acquired by The Washburn & Moen Manufacturing Company as an adjunct to the development of its far western trade. The use of wire rope for street railways, contrary to expectation, has diminished until it is almost negligible, but other uses for wire and wire rope have increased in inverse proportion to the cable railway demand, so that now the greatly enlarged California properties of the American Steel & Wire Company are required to properly care for and serve the increased Pacific Coast and Oriental export trade.

WORCESTER EXTENSIONS OF THE NINETIES

In 1890 the company commenced the manufacture of insulated wires in two leased buildings on Union Street, and in order to meet the increasing demand in electrical fields, it built, two years later at Quinsigamond, a factory equipped for the manufacture of all kinds of insulated wires for electrical purposes and cables insulated with paper or rubber, lead encased, steel armoured, or protected in any way, for aerial, underground, or submarine service in connection with incandescent lighting or transmission of power.

During the early '90s the company commenced to manufacture copper rail bonds for bonding the rails of electric railroads. Complete outfits of high-grade tools for installing these bonds were also produced. In 1891, the company erected at Quinsigamond a large factory for the manufacture of springs of every description, fine and heavy, including furniture, agricultural, motor and car springs. On May 19, 1894, the company leased the Venetian Red & Copperas Works on Hammond Street, Worcester, and later purchased the machinery, which was moved in 1897 to a building erected for the manufacture of copperas and Venetian red. At the end of 1906, the company ceased making Venetian red and now produces only sulphate of iron, formerly termed "copperas." Owing to the increasing demand for room for specialties manufactured at Worcester, the greater

part of the machinery for making barbed wire was removed in 1906 to several of the Pennsylvania units of the United States Steel Corporation.

The capital stock of the Washburn & Moen Manufacturing Company was increased on May 27, 1890, to \$2,000,000; on May 31, 1892, to \$2,500,000; on February 27, 1893, to \$3,000,000; on May 29, 1894, to \$3,500,000; and on May 26, 1896, to \$4,000,000.

Upon the death of Philip L. Moen, in April, 1891, William E. Rice became president of the corporation and held that position until March 11, 1899.

THE AMERICAN STEEL & WIRE COMPANY BUYS THE WASHBURN & MOEN
MANUFACTURING COMPANY AND THE WORCESTER WIRE COMPANY

Ambitious, able, and possessed of a daring which at times seemed to savor of recklessness, John W. Gates, the son of an Illinois farmer, began his business career as a grain dealer, later engaging in the retail hardware trade.

By a curious turn of the industrial wheel a quarter of a century following the kindling of his interest in the marketing of barbed-wire fencing, in the west, for I. L. Ellwood & Company of De Kalb, Mr. Gates became the prime mover in the purchase of the Worcester units of the Washburn & Moen Manufacturing Company, where so many tons of this commodity had been fabricated.

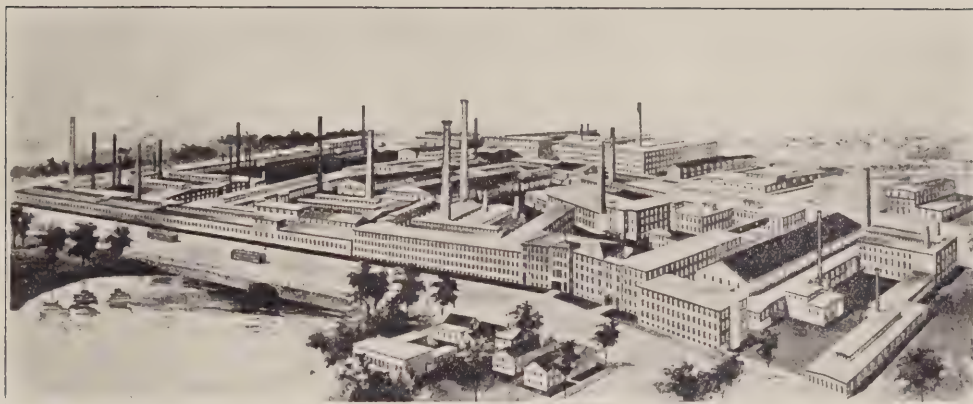
His success in obtaining large orders for barbed wire led to his decision to make as well as to market this product, and in the late '70s he launched the firm of J. W. Gates & Company, in St. Louis, which, in 1881, was succeeded by the Southern Wire Company. Mr. Gates, then twenty-six years of age, became president of the concern.

His two associates, Alfred Clifford and William Edenborn, with Isaac L. Ellwood, formed the Braddock Wire Company in 1884, and erected a plant near Pittsburg, designed to produce the wire to be barbed by the Southern Wire Company. Mr. Gates then bought the Iowa Barb Wire Company, of Allentown, Pa., and acquired an interest in the St. Louis Wire Mill Company, becoming vice president of both corporations. He and his associates next purchased the Baker Wire Company of Lockport, Ill., and in 1891 they formed the Columbia Patent Company. The following year Gates organized the Consolidated Steel & Wire Company, with capital of \$4,000,000, which acquired six wire and wire fence concerns. In 1895 he became president of the Illinois Steel Company and two years later was the chief promoter of the American Steel & Wire Company of Illinois, and also of its successor, the American Steel & Wire Company of New Jersey.

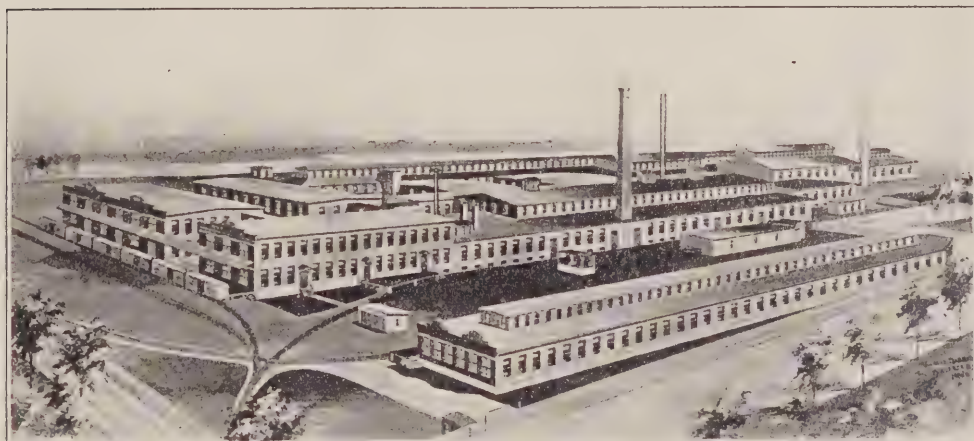
In 1899, Mr. Gates was the prime mover in the acquirement by the American Steel & Wire Company of the Worcester units of the Washburn & Moen Manufacturing Company, and of the Worcester Wire Company. On April 1, 1901, the American Steel & Wire Company became merged in the United States Steel Corporation, but the business of the former concern is conducted under the old name and by a separate organization.

FRED H. DANIELS—A PROLIFIC INVENTOR

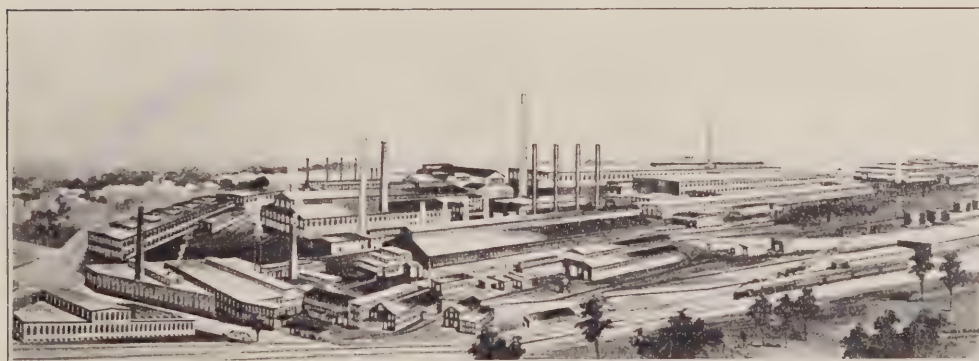
Fred H. Daniels, who for thirty years was the general manager of the old Washburn & Moen Company and of the American Steel & Wire Company, ranked as an inventor second to none in the steel and wire in-



AMERICAN STEEL & WIRE COMPANY
North Works, Worcester



AMERICAN STEEL & WIRE COMPANY
Central Works, Worcester



AMERICAN STEEL & WIRE COMPANY
South Works, Worcester

dustry, while as an engineer he solved many outstanding problems. His inventions date from the very beginning of his connection with the wire mills of Worcester, and were mainly in improvements in machinery and processes for making wire and rods. He was awarded a gold medal at the Paris Exposition, in 1900, for his achievements in the wire industry, and altogether received upwards of 150 patents, in the United States and in foreign countries, many of his inventions effecting a veritable revolution in wire-making and rod-rolling. From 1882 to the time of his death all his patents were assigned to the Worcester corporations, by which he was retained. In 1898 Mr. Daniels was formally presented to King Oscar of Sweden, and in 1910 he was decorated by King Gustaf and made Knight of the Royal Order of the North Star, first class, in appreciation of his contributions to the industry.

Successive managers of the Worcester plants have been Philip W. Moen, Charles Ranlet, Harry G. Stoddard, Clinton S. Marshall, and J. Lester Perry. In 1928, at his own request, Mr. Marshall, after twenty-four years of arduous and eminently successful service as manager, was relieved of active duty, but is retained in an advisory capacity as district superintendent. He was succeeded by J. Lester Perry as district manager.

The policy of the officials of the American Steel & Wire Company with respect to the Worcester plants has ever been one of further expansion and improvement.

In some instances, owing to lack of necessary space, or for purely economical reasons, large departments of the industry have been transferred bodily to the western plants, but their places have in all cases soon been filled either by the overflow from previously congested departments, or by the introduction of some branch of wire manufacture, already known to the trade, but not previously established in Worcester—as for example, the making of insulated wires and cables, which has become a local unit of large proportions, or by the instituting of pioneer work in developing a new industry, as in the manufacture of copper rail bonds.

Thus the manufacture of the more common products has been transferred to other districts and the Worcester plants have long since come to be known as the specialty producing units of the company.

THE FASTEST-OPERATING ROLLING MILL IN THE WORLD

The year 1927 saw the completion of the erection and installation of the \$2,000,000 billet and wire-rod rolling mill, at the South Works, which insured the continuance of the only plant in Massachusetts engaged in the manufacture of steel, and which spelled to Worcester the permanence of the production, from the open hearth steel furnaces to the steel rod, of the raw material from which wire is drawn.

What perhaps is more important is that this new plant makes it possible to turn out rods faster than they were ever produced before, whether in the United States or abroad.

The previous record for speed was 3,500 per minute, but the expert engineers of the Morgan Construction Company, of Worcester, who designed, built, and installed the rolling mills, succeeded in developing improvements on hitherto existing devices which stepped up the capacity to 4,200 per minute, a 24-hour output representing 2,200 units of rods, or an annual output of 100,000 tons.

The new unit replaced two old mills, and a third unit has been rebuilt along similar lines, which, when placed in operation, increased the capacity of the South Works to 150,000 tons per year.

The recently completed unit is the first mill in the United States to produce rods in 400-pound bundles, and the first in the world to manufacture coils of this weight in a size so small as what is termed in production circles, No. 7. The primary purpose of the new mill was to roll rods of higher quality at a cheaper price, and not necessarily to increase tonnage.

The three Worcester plants of the American Steel & Wire Company, adopted the most modern power methods by abandoning eight steam engines for twenty-eight electric motors, which furnish 7,645 horse-power, and they receive their supply of current from the New England Power Association's distant hydraulic stations on the Connecticut and Deerfield rivers, and in times of low water from steam plants, including those at Worcester, Providence, Fall River, New London and Weymouth.

It is perfectly obvious that the capital expenditure involved in this latest major extension would not have been made by so progressive a corporation as the American Steel & Wire Company, if its executives had not been convinced that Massachusetts is a state in which industrial production can be carried on as successfully as elsewhere.

Furthermore, it was a tribute to the inventive genius and the engineering skill of Bay State men to have the new plant designed and fabricated by a Massachusetts corporation such as the Morgan Construction Company, which is pre-eminent in the field of rolling mill production, although located thousands of miles from the seat of most of the steel mills in the United States.

Although the headquarters of the American Steel & Wire Company are located in the Middle West, the welfare of Worcester and its people has always been considered when making important decisions affecting the local district. William P. Palmer, the company's late president, was notably inclined to promote Worcester interests and with him, as well as with his successor, and the latter's associates, the sense of corporate responsibility has ever been strong.

THE COMPANY'S WELFARE WORK

One direct cause leading to greater efficiency in the company's local plants has been the improvement of working conditions, including the wholesale installation of safety devices and insistence upon the observance of "safety first" rules, better sanitary equipment, lighting and ventilation, cleaner mills and yards, attractive surroundings, skillful and efficient hospital, and surgical attendance, including the employment of district nurses for the benefit of needy employees and their families. The pension system, a part of the United States Steel Corporation's policy, provides pensions for 330 local retired employees who, in 1928, received \$147,514.40 in the aggregate.

The local employees are permitted to participate in the annual offerings of the United States Steel Corporation stock, in the savings bank plan, in life insurance protection, in the mutual relief association, in the recreation halls, and in the athletic fields maintained by the company. At Christmastide each year, upwards of 7,000 children and their attendants are provided with entertainment and refreshments.

All these and other activities have been developed within the past

thirty years as the response of wisely directed capital to the demands of an awakened public conscience.

In December, 1927, William P. Palmer, who had served as president of the American Steel & Wire Company since May, 1900, died. He was succeeded by John S. Keefe, who had been a director and first vice president, since 1901, and who had also served as general traffic manager of the corporation, from 1899 to 1927.

The other officers are, vice presidents, Frank Baackes, Henry A. Barren, and Dennis A. Merriam, with Elmer E. Stone, general purchasing agent.

MUSEUM OF THE WIRE INDUSTRY

In 1908, the late President Palmer founded an Industrial Museum, the primary purpose of which was to salvage and preserve the rapidly disappearing historic material relating to the wire industry.

Many of the exhibits now assembled cannot be duplicated, and would have been forever lost had they not been rescued, identified and placed where they would be cared for and rendered permanently useful.

The numerous collection of articles on display, including many photographs and models, may be seen by the casual visitor. In addition, the museum files contain a quantity of carefully indexed material invaluable to the student interested in the history of the industry, which may be examined and studied upon request.

The slowly but steadily growing collection bears silent but effective witness to the development of the wire business of America, and recalls many of the more prominent actors passing onto, across, and off the stage.

The purpose of the founder has been zealously followed, and after two decades, it is felt that the Industrial Museum of the American Steel & Wire Company, with even its present moderate accumulation of historic material, has fully justified its existence.

The Industrial Museum Committee, representing all districts, invites the public to visit the Museum, which is located in Worcester, in a separate building adjacent to the district offices on Grove Street, and where, during the business hours of the day, Arthur G. Warren, the efficient secretary of the institution, may be consulted.

The year of the Tercentenary of the Massachusetts Bay Colony completes a full century of growth and development from the humble, but courageous beginnings of the firm of Washburn & Godard. In 1830, they were shaping their plans for launching the Worcester wire industry the following year.

The two partners were men of vision as well as of action, but it is safe to say, their wildest dreams of the ultimate possibilities in wire manufacture and in the use of wire commodities were of the simplest of kindergarten methods compared with the marvelous development and achievements of the industry, attained within a single century.*

*The author acknowledges his great indebtedness to Mr. Arthur G. Warren, Secretary of the Industrial Museum Committee, of the American Steel & Wire Company and to the late Hon. Charles G. Washburn, of Worcester, for the greater part of the data carried in this historical sketch. Many of the facts embodied herein were compiled from information acquired by Mr. Warren during upwards of forty years' service at the North Works, and from material on file in the Industrial Museum.

WORCESTER AS A CENTER OF WIRE PRODUCTION

It is gratifying to note that in 1929, despite the assertions of our critics to the contrary, the wire mills in Worcester and vicinity, constituting the most important of the city's varied industries in the annual value of output, in the number of workers employed, and in the total of wages paid, were exceedingly prosperous. They operated close to maximum of production throughout that calendar year, and they paid their employees in salaries and wages, more than \$11,000,000 in 1929.

Where wire is produced in such myriad variety as it is in Worcester, the business rarely, if ever, runs even as between departments. Some may be overburdened with orders while others may not, but in 1929, the demand for all lines was good and for most of them better than good, and production proceeded with night and day operations.

The big works of the American Steel & Wire Company and the mills of the independent companies shared alike in these auspicious conditions, already long continued, and in the opinion of those closest to the situation, promising to be prolonged indefinitely. Concerning the future much significance is attached to the fact that the summer of 1929 brought with it only a slight recession in demand, instead of the slump which is always looked for with the arrival of hot weather. A few of the mills experienced a slight let-up, but in most of the plants production proceeded at full speed regardless of the extraordinary amount of extreme heat which characterized the season.

All departments of the Worcester Works of the American Steel & Wire Company were at least moderately busy, and a very considerable per cent of the equipment operated with night shifts. The company carried about 4,500 men on its local payroll throughout the summer and fall, and this prosperous condition was maintained for months.

The various plants of the Wickwire-Spencer Steel Company in Worcester and Worcester County also shared in the general prosperity of the wire business. All departments were busy, and considerable portions of the five works operated night and day. The Goddard Works carried 800 men on its payroll, the Morgan Works 400, the Clinton Works 750, the Spencer Works 200 and the Palmer Works 200.

The Wickwire-Spencer plants in Worcester, Clinton, Spencer and Palmer added considerable new equipment during 1929.

The Worcester Wire Works, Inc., increased the capacity of its plant some 33 per cent by the erection of an additional building during the summer of 1929, the new area being devoted to wire drawing. This company, now carrying more than 200 men on its payrolls, specializes on high carbon steel wires.

The Johnson Steel & Wire Company, youngest among the wire manufacturers of Worcester, is now employing 150 men. In 1929 it added 30 per cent to the capacity of its works by the erection of a building equipped for manufacturing processes. The company produces high carbon steel wires, used for such purposes as cables, springs and in automobile tires. The business was established less than three years ago.

The plant of the George F. Wright Steel & Wire Company, which specializes on wire fencing and particularly on poultry netting operated at capacity throughout the year, and employed about 200 men.

The New England High Carbon Steel Company ran its plant at Mill-

bury on full time with a working force of eighty-five men. The company manufactures high carbon wire specialties, such as music and spring wires.

The Seneca Wire & Manufacturing Company of Fostoria, Ohio, which in 1929, acquired the plant and business of the Wheeldon Wire Company at West Brookfield, is now operating the mill on a production basis, with fifty men on the payroll, which number, according to present plans, will be increased to 100 or 125 in the not distant future. The works are operated as the West Brookfield Branch and the output consists of wire in wide variety, both low and high carbon, the processes including galvanizing and tinning.

A new mill building, completed in 1929, by the Thompson Wire Company increased the capacity of the wire-drawing department about fifty per cent. The company operates mills in Milton and Worcester, and in the latter plant, now employing over 100 men, special wires are manufactured, the chief lines being card and brush types. Formerly it purchased its wire in semi-finished sizes, but now it draws all of its wire from the rod to finished sizes.

THE ALSATIAN MACHINE WORKS, LTD.

Located at 25 St. John's Road, is the plant of the Alsatian Machine Works, Ltd., which is closely identified with the present-day form of Atkinson, Haserick & Co., a concern that had its beginnings in the early part of the nineteenth century, when J. G. Tappan, of Boston, established the business, which he soon sold to Henry Edwards, who, in 1823, admitted to a partnership, Charles Stoddard, and formed the firm of Edwards & Stoddard. Three years later, upon the death of Mr. Edwards, a new partnership was created, with J. S. Lovering, then a clerk in Mr. Stoddard's office, as a member. At that period silks, ribbons and millinery goods were dealt in, and shortly afterward a Paris house was started, under the name of J. S. Lovering & Co., which was managed by Mr. Lovering.

In 1846 he returned to Boston, from France, and the firm of Stoddard, Lovering & Co., was formed.

In 1859, F. A. Haserick began business in Manchester, England, and was appointed agent for Stoddard, Lovering & Co., dealing in Manchester fabrics and cotton yarns. Five years later the Paris house was discontinued, and F. A. Haserick, E. W. Dean and J. L. Barry became partners in the Stoddard firm, and the Manchester business was transferred to that concern. In 1880, Mr. Haserick began operations in the textile machinery and wool fields, and leaving Manchester he came to America, at which time the English office was removed to Bradford, England.

The Stoddard firm became sole agents in the United States of Messrs. Prince, Smith & Son, worsted machine manufacturers, of Keighley, and of Messrs. Dobson & Barlow, Ltd., cotton machinery manufacturers, of Bolton, England.

In 1889, Charles E. Richards, E. W. Atkinson, Arthur A. Haserick and F. S. Coffin were admitted to the Stoddard partnership, and E. W. Dean, then the resident New York partner retired from the firm, and founded the shoe-finding concern known as Dean, Chase & Company.

From that time on the business of Stoddard, Lovering & Co., was almost exclusively centered in the textile machinery and wool fields.

In 1890 the business of importing cotton direct from Egypt was begun, and five years later the firm name became Stoddard, Haserick, Richards & Co. In 1908 it took the name of Richards, Atkinson & Haserick. Following the death of Mr. Richards the concern became Atkinson, Haserick & Co., and in 1914 J. L. Coon became a partner. Three years later Horatio W. Nelson was admitted to the firm.

During the World War the concern purchased for its clients in France and exported to them large quantities of structural steel, electrical steel sheets, gun castings, etc., receiving no commission thereon and making no charge for its services.

In 1924 the firm became a voluntary association, with E. W. Atkinson, J. L. Coon and H. W. Nelson, as trustees, and with the retirement of the latter four years later, Messrs. Atkinson and Coon became the sole trustees.

After a successful career of more than a century the concern continues to act as sole agents in this country for the Keighley and Bolton, England, concerns, and also for the Societie Alsacienne de Constructions Mecaniques, in the machinery fields, and for Messrs. Carver Brothers & Co., Ltd., of Alexandria and Manchester, in the Egyptian cotton field.

The Boston office of the Alsatian Machine Works, Ltd., is at 152 Congress Street.

RICE, BARTON & FALES, INC.

In 1837 when Worcester was a modest town of 7,000 inhabitants, Howe & Goddard formed a partnership to manufacture paper and pulp mill and textile machinery—the predecessor of the famous corporation known today as Rice, Barton & Fales, Inc.

George M. Rice was admitted as a partner in 1847. In the adjoining town of Millbury, there was born in 1825, George Sumner Barton, who at the age of twenty years, was apprenticed to Goddard, Rice & Co., as a machinist, later becoming its foreman, and on May 1, 1862, he, with Mr. Rice and Joseph E. Fales, formed the firm of Rice, Barton & Co., which five years later, became the corporation known as The Rice, Barton & Fales Machine & Iron Company. For sixty years thereafter the corporate name remained as such until, in 1922, without change in management, it was shortened to Rice, Barton & Fales, Incorporated.

From May 1, 1862, to October 17, 1891, when his death occurred, George Sumner Barton was the head of the enterprise, his remaining associates, Messrs. Rice and Fales having disposed of their interests to him a few years after the original incorporation. The business prospered under his able management, and he found time to serve his fellow citizens by membership in the city council and the board of aldermen, as well as in the Massachusetts Senate. Mr. Barton was also president of the Boston, Barre & Gardner Railroad Company, a director of the Boston & Providence Railroad Company, president of the Worcester County Mechanics Association, and president of the Worcester Safe Deposit & Trust Company.

Upon his death the business passed to his son, Charles Sumner Barton, and the following year the old site in the center of the city was sold, and a new location secured in the then undeveloped south section of Wor-

cester, where a new plant was erected, which has since been enlarged and equipped with facilities to take care of the constantly increasing size of machinery demanded by the trade. Upon the death of Charles Sumner Barton, in 1914, the third generation assumed the reins of management, when his son, George Sumner Barton, the second of that name, became president and treasurer of the corporation.

At various periods, steam boilers, the Vandewater waterwheel, calico-printing, dyeing and bleaching machinery, as well as paper-making equipment, with hydraulic presses and architectural iron work, were among the products, but in recent years the activities of this \$1,000,000 corporation, now employing upwards of 400 skilled mechanics, has been confined to paper mill and textile printing machinery and to heavy foundry and machine work. With the advent of pulp paper the manufacture of pulp machinery became prominent in the company's work, and it is the exclusive builder, in this country and Canada, of many patented machines. It has the record of turning out some of the biggest paper-making machines, for the manufacture of newsprint paper, ever fabricated. Most of the textile machines now in operation in this country were produced in the Rice, Barton & Fales plant.

The advance in paper manufacturing machines is vividly portrayed in examining the devices of eighty years ago with those of half a century since and of the products of today.

In 1850 the largest Fourdrinier machines built by the concern produced paper 72 inches wide, while the cylinder machines ran from 40 to 62 inches.

By 1877, the year the American Paper & Pulp Association was formed the Fourdriniers produced by the company did not exceed 84 inches and the cylinder machines produced paper 56 inches wide. In fact, it was not until 1890, that Rice, Barton & Fales, then over half a century in business, built the first machine over 100 inches wide.

But today few Fourdriniers are built by the concern that produce paper less than 100 inches wide, and the company frequently turns out this type of machine capable of producing paper 154, 160, 170, 210 and 234 inches in width.

It is also of interest to note that the name of not one of the customers served by the concern in 1850 can be found listed in a paper mill directory of today. The company is proud of its employees who have seen long service with it. There are between twenty-five and thirty men who have been carried on its payrolls twenty-five years or more; approximately ten who have served it upwards of forty years, and two who have worked in the plant more than fifty years.

Naturally the logical sequence of the company's long years of specialization is that when a textile concern decides to install a printing department, or an existing print works is interested in bringing out an untried novelty, whether it be silk, rayon, velvet, cotton, jute, or paper, its executives turn to this old-established concern with an unbroken record of nearly a century of successful machine production. It matters not whether it is silk for milady's dress or a blanket for Zev, the conqueror of Papyrus; a small silk flag to be sold in a package of cigarettes, or a nine by twelve rug; shirting printed in one color or the bizarre effect of a piece of silk of fourteen colors; red, white and blue bunting printed on both sides or a small duplex machine, or a piece of wide silk printed in seven

colors on each side by a monster 25-ton machine, the textile trade turns to this concern, fitted by experience to design, and with a plant physically equipped to construct any machine that can possibly be desired by the textile trade.

J. Warren Vedder is vice president and general manager, and Lester M. Start, is secretary of the corporation.

Proud of its long and uninterrupted business career of nearly a hundred years, its corporate officers realize now, more than ever before, that eternal vigilance is the price of progress, but they approach the second century of the existence of the concern with the utmost confidence in their ability to continue to lead in its chosen line of production.

To that end they pledge anew their allegiance to the Commonwealth, and are determined, through scientific and industrial research, to keep their machinery in the forefront, realizing that they have helped to uphold the traditions of her industries for almost ten decades, and believing that they can continue to maintain the enviable record of the corporation in the future. Retrospection of the history of the concern is not only gratifying and satisfactory, but it begets in the present generation an appreciation of the aims and accomplishments of the generations that have gone before. It opens up a vista of future success, where the present and future generations can emulate the virtues and activities of their forefathers and determine to carry on the work so successfully initiated by the founders.

The Company's products, originally confined in its distribution to the New England field, now go to all parts of this country and across the seas as well.

SAMUEL CROMPTON CONQUERS NAPOLEON

Spinning by hand is a slow process, and prior to the advent of the mechanical age substantially all of this work was carried on by girls and women. Children were taught to spin at the ages of four and five, and they continued the art throughout their lives, unless they married, and hence was derived the word, "spinsters," denoting an unmarried woman.

It was difficult for the weavers in England to secure sufficient yarn, and to make matters worse the hand loom, though very inefficient as compared with the power loom, was infinitely more productive than the spinning wheels. When John Kay's "flying shuttle" appeared, enabling the hand loom to be operated by one, instead of two men, as previously, a serious dislocation of the spinning and weaving industries occurred.

Kay's invention consisted of pickers at each end of the lathe, which were united by a loose-hanging cord, with a peg in the center, and there existed no longer the necessity of having one man at each end of the hand loom to throw the shuttle from left to right, or vice versa. One weaver could do that after Kay's device came on the market, and what was still more exasperating to the workers was that not only did his invention dispense with the services of one weaver, but the latter could do double the work formerly performed by two. In other words, a loom equipped with Kay's flying shuttle was four times as efficient as the old style apparatus. The invention emphasized the necessity of effecting improvements in the methods of spinning yarn in order to provide the looms with the materials for weaving, and the ingenious inventions of Wyatt, Hargreaves, Arkwright, Paul, and others followed.

But the rapid production of yarn by power had its limitations. It was not strong, and fine counts could not be spun on any of the machinery invented up to the period in which these pioneers produced their inventions. Came Samuel Crompton, who promptly remedied the situation by inventing his so-called "spinning-mule," which provided yarns, both strong and fine—a contribution the influence of which upon cotton production can scarcely be over-estimated. From the date of its appearance the English cotton industry went forward by leaps and bounds, became the greatest source of revenue of all the trades and occupations, and was so profitable that it has been said that Samuel Crompton was the real conqueror of Napoleon, because, as all have recognized, it was only through the sheer source of England's wealth that she and her allies were able finally to subdue the great Emperor and soldier, and this accumulated wealth flowed largely from Crompton's invention.

THE INFLUENCE OF THE STEAM ENGINE UPON THE TEXTILE ART

There was another contemporaneous agency at work destined to revolutionize modern society, and while its initial contribution was in a field of industry far removed from textile development, it was destined to play a very important part in advancing the manufacture of all kinds of fabrics.

From the earliest times iron had been smelted by means of charcoal. To obtain this commodity, the timber reserves of England were drawn upon heavily with the great increase in iron manufacture, and when her statesmen saw that either it was a case of jeopardizing the future of the nation by curtailing the construction of wooden naval and merchant vessels, or giving the iron masters unbridled license to turn all the native timber into charcoal, they reached the conclusion that the country could have an adequate navy only if it possessed a strong merchant fleet. Laws were at once enacted for the preservation of the forests, and this policy extended to her colonies, where immense tracts of timberland were acquired as the King's Forests.

This inhibition compelled the iron masters to return to the method that had been previously employed and discarded, namely, of smelting iron with coal. The success of the plan was not without its troubles. The coal pits filled with water, and hand-pumping was inefficient and expensive. Some genius among the ironmongers suggested using the steam engine, then recently perfected by Watt, and at that period scarcely more than a laboratory toy. It solved the pumping problem and then Watt and Boulton, who were associated in their experiments, developed rotary power.

No longer was industry the groveling slave of wind, horse, water, or hand power.

A new vista appeared on the manufacturing horizon. The uncertainties and the limitations of these former sources of power were at once superseded by an unlimited and reliable agency. The development of the steam engine was rapid, and its application to the spinning and weaving of cotton and woolen yarns and fabrics by power was soon effected. The old mechanism of light construction, designed for hand, water, horse, or wind power, would not withstand the rigorous energy flowing from the steam engine, and thus began the invention and manufacture of all sorts of textile machinery to meet the new conditions.

Next followed Eli Whitney's key invention—the cotton gin—about which revolved the entire future of the cotton textile industry. Lacking a machine that would separate the seeds from the cotton plant the great textile inventions would have been circumscribed in their usefulness, and neither English nor American cotton manufacture would have made the phenomenal progress that has been recorded.

A MAN OF THE CLOTH SOLVES THE PROBLEM OF PRODUCTION

These contributions had completely reversed the critical situation that followed in the wake of John Kay's invention. At that period the weavers were hampered by lack of a sufficient supply of yarn. Now that the latter could be spun by rapidly moving spindles, operated by steam power; the weavers found themselves surfeited with yarn which they could not weave into cloth fast enough to consume what was delivered to them, or to supply the demands of consumers. The Arkwright patents were about to expire at this time, and with a free field in the manufacture of yarn it became apparent that overproduction would glut the industry.

The problem became the subject of constant discussion in the Manchester district, and on a stage coach trip when Edmund Cartwright, a Kentish clergyman, chanced to offer what appeared to him to be a simple solution, to the effect that Arkwright, then the most successful English cotton textile operator, should invent a power loom, his fellow-passengers made up of manufacturers from Manchester, blandly replied that such a plan was chimerical. In support of their contention they emphasized that spinning operations were continuous, while the movements of a loom were intermittent; that the weaver changed his shed by means of treadles and through the Kay picking motion shot the shuttle through the shed; and that after changing the shed, the weaver shot the shuttle back—all of which operations they asserted were simply impossible of being carried on by machinery.

The clerical interloper countered by stating that he had been informed there was a machine then in London that played chess, without the intervention of a human being, and he argued that if a person could invent a device that would execute the intricate moves involved in chess, surely human ingenuity ought to be able to produce a power loom. Just what would have happened had Cartwright realized that concealed in the alleged London automaton was a legless youth who made the moves on the chess-board is interesting to conjecture.

He then and there determined to invent a power loom himself, and while his first model was crude, because at that time he had never even seen a hand loom, he succeeded in his attempt. His product, however, did not come into immediate use, and had it not been for a grant from Parliament, he would have secured little financial reward. Later he produced other textile devices, notably a combing machine, and these inventions enabled him to accumulate a fortune.

Horrocks, Roberts, and other Englishmen perfected the primitive loom, and soon the hand-loom operators found they must enter the factories and run the new apparatus, or starve. In appearance the device resembled the power loom of today, but in performance there is little comparison between it and that of the equipment of the present period. It was a plain loom, upon which only the simplest fabrics could be woven. If one

desired a textile product carrying a design of any kind he found he must resort to a hand loom.

Consequently there was accentuated the march of the industrial revolution from the pioneer to the refinement stage, and it was seen that from the economic standpoint the hour had struck when fabrics of simple or complicated design must be wrought on the power loom if the demand was to be supplied.

WILLIAM CROMPTON'S GREAT CONTRIBUTION TO THE TEXTILE WORLD

But how was it to be accomplished!

The answer was soon to be forthcoming. On the tenth of September, 1806, there was born in Preston, in the very heart of the Lancashire district of England, one who while still in his teens demonstrated unusual mechanical ability, and who before he was thirty was in complete charge of a mill, in Ramsbottom.

Just as he was turning thirty, he sailed for the United States and entered the employ of Crocker and Richmond, in Taunton, and in their cotton factory he developed the loom for the manufacture of fancy cloth fabrics, upon which he received a patent on November 23, 1837.

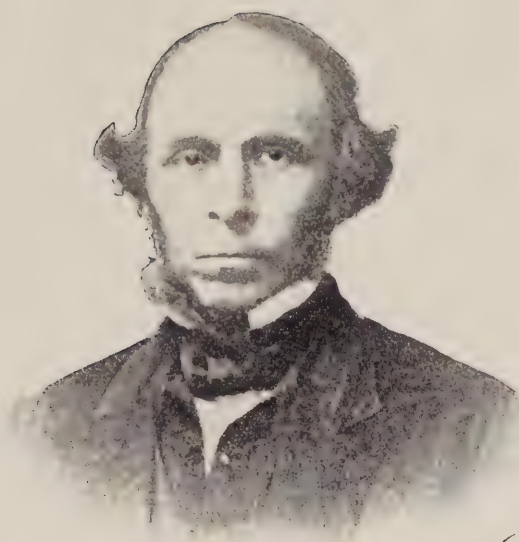
It was in this loom that William Crompton depressed one part of the warp, while the other was lifted, thus securing more room for the passage of a shuttle than had been afforded in any loom previously invented. Another basic feature was the chain, which, with its peculiar apparatus, operated the warp.

It must be recalled that up to this time all the inventors and producers of power looms had relied exclusively on cams for their intermittent motion—a feature still retained on many looms today for the picking motion, and also still used to a great extent for the harness motion, but the loom equipped with the cam harness motion is practically, though perhaps not theoretically, limited in harness capacity. The difficulties of changing the pattern on a cam loom were so obvious that William Crompton saw the need for a light harness motion which would permit of easy alteration of the pattern; and this constituted the great basic principle of his stellar contribution to the textile art. In this harness motion there was attached for the first time in the history of weaving the now every-day device, known as the pattern chain—a series of rollers on lags arranged in chain-like form, which, when turned over by a cylinder, and carried underneath or against levers, caused these rollers to be moved upwards or sidewise at pre-determined intervals.

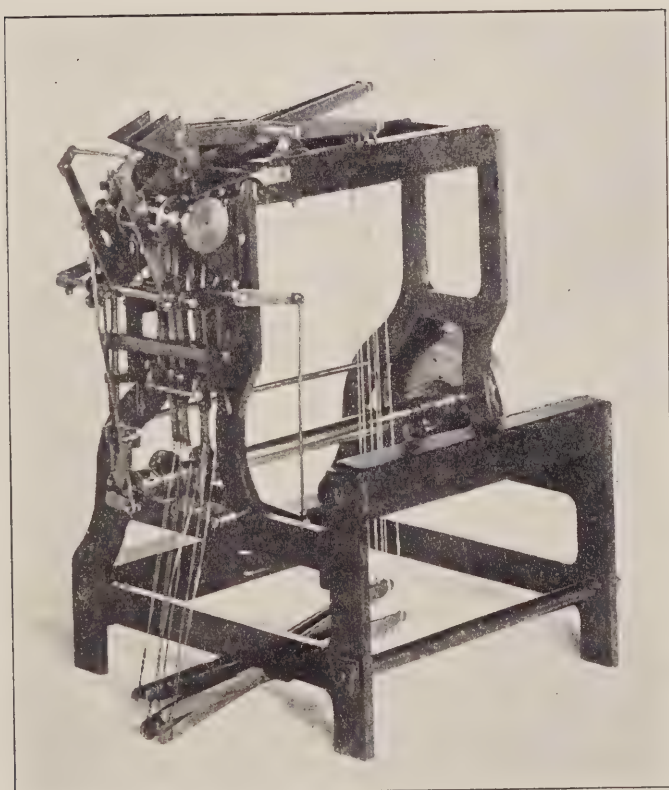
In the operation of these levers, they were caught by a movable knife, and when they moved downward by gravity or by a spring, or sidewise by the spring of the jack itself, were engaged by another knife, moving in the opposite direction—a process which raised and lowered the harnesses at the required time and caused the desired pattern to be woven on the loom.

The original model of this epochal loom was presented by Messrs. George and Randolph Crompton, of Worcester, to the National Museum, at Washington, D. C., where it now reposes, and a perfect replica of it is to be seen in the Museum of the Crompton & Knowles Loom Works, in Worcester.

It is interesting to note the sequence of the major inventions which exercised such a potent influence upon the textile art.



WILLIAM CROMPTON
Inventor of the Power Loom



THE FIRST LOOM INVENTED BY
WILLIAM CROMPTON

A little more than one hundred years had elapsed between the date of the invention of the fly shuttle by John Kay before William Crompton, produced his cotton loom—the first in the world to use a pattern chain for governing the movement of the harnesses, all looms previously employed having been equipped with the cam harness motion.

Kay's fly shuttle appeared in 1733, and prior to its advent the shuttle had been moved through the shed of the hand loom by the fingers of the weaver. In 1760 Robert Kay invented the multiple cell drop boxes and in 1785 Dr. Edmund Cartwright brought forth his power loom, with its positive let-off and equipped with filling and warp stop motions, while seven years later he obtained his last patent on multiple cell shuttle boxes.

It was in 1803 that William Radcliffe invented his beam warping and dressing sizing machine which made possible the use of the power loom, whose continuous operation previously had been limited because of an insufficient supply of warp, and four years later steam power was first applied to the Cartwright loom.

For the moment it must have seemed to William Crompton that his great contribution had been destined to burst upon the textile world at a most inauspicious moment, and in a decidedly unfortunate environment, for no sooner had he applied it to a cotton loom, in Taunton, than the political machinations of Andrew Jackson in closing the United States banks brought on during the very year Crompton's patent was granted a financial panic so severe in its ramifications as to necessitate the suspension of operations at Messrs. Crocker & Richmond's mill.

Sensing the situation, Mr. Crompton saw no immediate opportunity for the application of his invention in the United States, and he at once decided to return to England. Upon arrival in his native land, he protected his invention by securing a patent in the name of his attorney, John Roston, and made application for similar protection in some other foreign countries in which his new textile machinery had been successfully introduced.

One English textile mill was equipped with his device, and two years later, when the financial clouds began to disappear in the United States, he returned to this country, with his family, and, in 1840, journeyed to Lowell and other textile centers in New England.

He was destined to disappointment at the outset, as he found the textile manufacturers in no mood to become interested in his invention, and returning to Taunton, he reentered the employ of Messrs. Crocker & Richmond, who by that time had partially recovered from their financial troubles.

WILLIAM CROMPTON PRODUCES THE FIRST FANCY WOOLEN LOOM

Once again the searcher who is interested in studying industrial lore is impressed by the fact that what at the moment may seem a detached and unimportant incident is likely to play a momentous role in the advance of the mechanical arts. The genesis of William Crompton's next great contribution to textile development is best told by a letter written in 1874 by Samuel Lawrence to George Crompton, the son of the famous inventor, reading as follows:

Stockbridge, Mass.
December 14, 1874.

George Crompton, Esq.

My dear sir:

Having had a most agreeable acquaintance with your honored father in the early history of your famous loom, and knowing it to have been a golden heirloom to you, I thought it would be interesting as a matter of history in our industrial pursuits that the circumstances of it being so distinguished in woolen fabrics be narrated.

Not a yard of fancy woolens had ever been woven by power loom in any country until done by your father at the Middlesex Mills in Lowell, in 1840. Your father invented this loom in Taunton, Mass., in 1837, took it to England the next year, where it was patented; and he filled one cotton mill there with them, and started it successfully, then returned to this country late in 1839. Early in 1840 he was in Lowell with specimens in cotton fabrics of what his loom could do. At that time I had charge of the Middlesex Corporation, and upon seeing the specimens remarked that woolen fabrics were only worn with plain surfaces, and his loom could not be used for that. The cotton manufacturers of Lowell did not see it for their interest to change their fabrics, and your father returned to Taunton.

Within ten days after this interview my old friend, William R. Draper, arrived in Boston from Paris (where he had lived fifteen years), and came to pass the night at my house in Lowell. He had an overcoat woven in diamond figures of great beauty. He said he "saw it at an Exposition in Paris; Bonjean & Son of Sedan were the manufacturers; and it was as sure to be popular as the sun was to rise." He gave me a small piece from inside the collar, and the same day I sent a man to Taunton for your father.

Both returned in a few days, bringing one of his original cotton looms, with which we experimented till its practicability for woolen fabrics was demonstrated.

Your father continued with the Middlesex Corporation two years, and I saw him daily. He was modest and gentle, and impressed me with the belief that he was highly gifted with genius. The attention shown you at the last Imperial Exposition in Paris, by the leading woolen manufacturers of Europe, shows that the services of your father and yourself are as highly appreciated abroad as at home.

I remain,

Your friend,
SAMUEL LAWRENCE.

Another letter, written by James Cook, the agent of the Middlesex Mills in 1840, is also important in connection with William Crompton's invention.

Lowell, Mass.,
March 27, 1877.

George Crompton, Esq.

Dear Sir:

The writer, now in his eighty-third year, in looking over a lot of old samples, came across a piece of fancy-woven cloth, the *very first* woven in this country by power, and the idea crossed his mind that it might be interesting to you to learn the beginning of this great revolution in the fabric now in use very generally in this country, to the extinction of the plain fabrics, formerly used to a great extent.

Your father came to the Middlesex Mills in this city, from Taunton, and represented to the writer and Mr. Edward Winslow (now deceased), the machinist in the employ of the Middlesex Company, that he had a loom in Taunton for weaving fancy cottons which he thought might be applied to woolen fabrics. The cotton loom was sent for by the Middlesex Company. Mr. Winslow and myself altered one cassimere loom with the assistance of your father, who was a skillful mechanic, by putting on Crompton's patent. The experiment was an entire success. The alteration was extended very soon to all the cassimere looms and then the broad looms; so that the whole of the weaving power of the mills was in that direction. The result was that, during the third year after, this company declared a dividend of 33% * * *

The Crompton looms have been so wonderfully improved by the experience, skill and ingenuity of the present owners that the first looms would now hardly be recognized; but the germ was there.

Respectfully yours,
JAMES COOK.

Thus it was that, in 1840, in the Middlesex Mills, in Lowell, fancy woollens were woven by power for the first time in the United States.

At least three-fourths of all the woolen goods now made in this country are woven on the Crompton loom, or on looms embodying its basic and improved mechanism.

The great success achieved by the looms at the Middlesex Mills at once became the wonder of the textile world, and William Crompton received many requests to install his invention in other plants. It seems not to have occurred to him to produce his own looms, for he still continued in the cotton manufacturing business. His original idea was to locate a well-equipped machine shop, where the looms might be produced on a royalty basis, and he visited Lowell, Lawrence and Dedham, and was about to close a contract with a firm in the former place when a chance meeting in a Boston hotel with Samuel Davis, of Worcester, then engaged in building carding and spinning machinery in the old Court Mills, in that city, led him to give consideration to the suggestion made by Mr. Davis that Worcester would be an excellent place in which to have his looms constructed. Mr. Davis was confident that Messrs. Phelps & Bickford, of his home city, were well equipped to undertake the work.

WORCESTER BECOMES THE HABITAT OF THE CROMPTON INVENTIONS

Journeying to Worcester, and examining their plant, William Crompton lost no time in effecting an arrangement to have his looms built by them on a royalty basis, which contract continued until the expiration of his patent. This proved to be a fortunate circumstance for the city and county of Worcester, even then distinguished in the mechanical arts because of the major contributions through ingenious and important inventions and improvements already made by such leaders as Eli Whitney, Ichabod Washburn, Elias Howe, and others, and which were to be followed by those of Erastus Brigham Bigelow, Russell L. Hawes, Osgood Bradley, George Crompton, and a host of others. It could not then be foreseen that Worcester County was to be the habitat in the years to come of the three most important textile machinery manufacturing concerns in the United States—the Draper Corporation, the Crompton & Knowles Loom Works, and the Whitin Machine Company—the first two

of which produce probably ninety per cent of the weaving machinery made in the United States today.

Perhaps this may be said to be but a natural development, inasmuch as power looms have been manufactured in Worcester for more than a hundred years. Ichabod Washburn spoke of seeing a power loom there in the winter of 1813-14, and as early as 1823, William Howard and William Hovey began building broad power looms, the former being succeeded by Messrs. Wheelock and Prentice, while, in 1832, Horatio Phelps acquired the right to manufacture the Howard improved loom, and carried on business in the shop formerly occupied by William Howard.

It was in 1833 that the partnership of Phelps & Bickford was formed, and that same year Prescott Wheelock was constructing looms in his shop, in New Worcester, while two years later Fitzroy Willard manufactured looms, in the Court Mills.

Shortly after William Crompton had entered into arrangements with Messrs. Phelps & Bickford to build his looms, he leased a mill owned by Ichabod Washburn, F. W. Paine, and G. A. Turnbull, located in that part of Worcester, then called Northville, and when it was destroyed by fire, in 1844, he removed to Millbury where he engaged in the manufacture of woolen and cotton goods, and where he also operated a machine shop and foundry, disposing of the latter units in 1848, but continuing to produce cotton and woolen fabrics. A little later he removed to Hartford, Conn., where he died on May 1, 1891.

For decades before his death he had taken his place as one of the outstanding geniuses of America. His versatility was known to those who observed the every-day activities of this uncommon man who made his impress upon all with whom he came in contact. It is related that on his first trip across the Atlantic, the ship's pumps failed to work, and volunteers were called for among the passengers. He promptly set at work upon the problem and soon succeeded in restoring the functions of the pumps, thus becoming instantly the hero of the voyage.

His major invention of the fancy loom was of continuing importance and significance, for with the exception of Jacquard and cam looms, every power loom in the world today employs the devices contributed by him, and moreover, the chain of rollers or pegs is used at the present time for a myriad of purposes. The Crompton looms performed for the art of fancy weaving what the Cartwright looms did for plain weaving.

HIS MECHANICAL ABILITY IS TRANSMITTED TO HIS DESCENDANTS

As one studies the life stories of America's great inventors he is impressed with the paucity of instances where the genius of a great mechanical mind is imparted to his descendants. One of the outstanding exceptions to the general rule is found in the Crompton family.

The eldest son of William Crompton was born at Holcombe, in Lancashire, England, on March 23, 1829, and was christened, George. He was but seven years of age when his father's first patent on the fancy power loom was granted, and but ten years of age when William Crompton brought him to America.

He attended the public schools of Taunton and Worcester, and later Millbury Academy, and, following his scholastic education, was employed as a bookkeeper in his father's mill office, in Millbury, later working for the Colt Company, at Hartford, Conn.

In 1851, his father's original patent was due to expire, and realizing that only under exceptional circumstances was it possible to secure an extension for a seven year period, George Crompton, after refusing an advantageous offer of promotion by his Hartford employers, journeyed to Washington, where he was successful in persuading the officials of the United States government to lengthen the period of legal protection.

Returning to Worcester, the son formed a partnership with Merrill E. Furbush to manufacture the Crompton loom. They had scarcely gotten under way when the Merrifield Building, in which their shop was located, was destroyed in the greatest conflagration Worcester has experienced in its history,—a disaster so widespread in its effects as to justify the mayor of the city issuing a call of the citizens to take action looking toward the alleviation of the suffering thus occasioned, and to find quarters for the large group of manufacturing enterprises whose physical assets were so suddenly wiped out of existence.

For a time, Furbush & Crompton carried on the production of looms in the Grove Street wire mill, and later the firm leased the Red Mill, near the foot of Green Street, where they employed fifty hands—a large force for that period.

GEORGE CROMPTON'S EARLY INVENTIONS

It was on November 14, 1854, that George Crompton received the first of the long list of patents granted to him, this initial award covering the substitution of a single cylinder-chain for two or more different patterns, which greatly simplified the operation of the loom for varied kinds of weaving.

ANOTHER GREAT CONTRIBUTION

In 1857 he developed a broad, high-speed fancy loom of twenty-four harness capacity, 96 inches between swords, with three shuttle boxes at each end, operating at a speed of eighty-five picks per minute. Up to that time no woolen loom ran at a speed of more than forty-five picks a minute. The new loom was a great stride in efficiency of production, and no advance in the intervening years has been so marked, although improvements stepped up speed from George Crompton's eighty-five picks, to ninety, ninety-five, one hundred, and to one hundred and twenty-five picks a minute, but the speed in no case was comparable to the increase he provided from approximately forty-five to eighty-five—almost double the former rate. What is still more important is the fact that practically all of the old looms operating at forty-five picks were of the narrow type (45 inches), and that by increasing the width to 85 inches and the speed from forty-five to eighty-five picks per minute, the George Crompton loom nearly quadrupled production.

The loom of 1857 attained its extraordinary results by various developments in its construction, among which may be cited the operation of the lathe by means of ordinary cranks; the reduction in the size of the shed, and the consequent use of the narrow shuttle.

Furthermore, the new George Crompton product was the first fancy loom made in the general form and proportions which experience has shown beyond peradventure to be the most satisfactory, and in these respects it became the accepted standard for all looms of this type in both the United States, and, after 1857, on the European Continent.

On April 27, 1858, a patent was granted to Mr. Crompton for a mechanism by which the warp-threads, which were required to be in the same position during two or more throws of the shuttle, were retained in their position. Previously the heddles controlling these threads had been brought, each pick, to a central line.

By purchase, Messrs. Furbush and Crompton acquired a number of patents, including those granted E. W. Brown on double reverse motion.

In 1858, the firm brought out the horizontal loom,—the first type for weaving poplins and the second for producing woollens. This loom had a wide and continuing vogue and was favorably regarded because of its freedom from mispicks. But like all looms, even those of the present day, it possessed its strong and weak points, and when the new fancy Crompton loom, called the "Bow Jack" by the weavers, was introduced, it largely superseded the horizontal type. Both machines, however, remained in demand and it was not until the early nineties that the horizontal loom went off the market altogether.

On August 1, 1859, the firm of Furbush and Crompton was dissolved, and Mr. Crompton bought the Red Mill, where he continued the manufacture of looms, while Mr. Furbush moved to Philadelphia, where he also produced looms.

At the time of the dissolution of the firm, the patents granted to and owned by it, which included in part E. W. Brown's invention of the double reverse motion were territorially divided by mutual agreement, Mr. Crompton taking the New England states and New York, and Mr. Furbush the remainder of the country.

In 1860, George Crompton erected a brick addition to his mill, 110 feet by 50 feet, and three stories high. He then employed sixty hands, and later increased the total considerably.

At the end of 1860, William M. Bickford, the successor of Phelps and Bickford, advertised that he was prepared to build all kinds of Crompton looms, which action led to litigation, and Bickford was found to be an infringer of the Crompton patents. Later his business was acquired by the Crompton Loom Works. With the advent of the Civil War, the orders for looms almost ceased, and George Crompton demonstrated his customary resourcefulness by devoting his works to the manufacture of machines for making gun stocks.

In 1863, upon the resumption of orders for woolen and cotton looms, in all their varieties and widths, for blankets and uniform cloth, he increased the capacity of his plant, operated overtime, effected simplification in operation, and developed the speed of his products. Up to 1865, he preserved the configuration of the loom as originally built by his father, but in that year he adopted vertical looms and other devices for operating the harnesses, receiving a patent on these improvements on January 9, 1866. The next year he exhibited his modernized loom at the Paris Exposition, where it was in competition with seven others, all of European manufacture representing inventors of England, France, Saxony, Belgium and Prussia, but it alone received recognition of special merit in the form of a silver medal—the only prize that was awarded on looms.

The new loom created a sensation abroad, especially among the continental loom makers, and afterwards it was illegally but slavishly copied. George Crompton arranged with one continental manufacturer to make

his looms under a license on a royalty basis. The licensee, although producing the looms in large numbers, made no payment of royalties, and it was found when lawsuits were commenced that he was so strongly entrenched politically and otherwise as to make it impossible to effect collections. Other manufacturers in Belgium and Austria also copied the loom, and it became the standard woolen loom of the Continent.

In 1868 George Crompton produced a new and unique device, styled the horizontal harness motion; upon which he received a patent January 31, 1871.

HALF A HUNDRED PATENTS FOLLOWED

Six years later he was given a patent on his chain tappet loom, a new departure in harness motion, and altogether more than fifty patents were awarded him for harness mechanism, picker movements, let-off and stop motions, shuttles and shuttle-boxes, drop-boxes, shipping mechanism, rocking-plate, a device for finding the pick when broken or exhausted, as well as upon improvements in the form of certain parts of looms designed to give them a more ornamental and tasteful appearance. Eight patents were received by him on textile fabrics, including tapestry carpeting and pile-woven goods, and, beginning in 1874, Horace Wyman, then superintendent of the works, was associated with Crompton in devising some seven inventions upon which patents were granted. By purchase and assignment, Mr. Crompton acquired control of more than fifty other patents associated with the manufacture of looms.

In 1875, he introduced into this country the Keighley Dobby loom, and in association with Mr. Wyman, he improved this apparatus, altering it so that a single index chain could be employed. Messrs. Crompton and Wyman rendered this mechanism more satisfactory by making it possible to place it at the end of the arch instead of in the center as on the English loom. Experience had shown that a certain amount of oil was sure to drop from the mechanism to the warp and injure it, and the improvements of Messrs. Crompton and Wyman not only obviated this difficulty, but facilitated the repair of the loom.

The dobby loom, which controls a larger number of harnesses than can be operated on a plain loom, was invented in England, but it is obvious it was an adaptation of the chain motion devised by William Crompton, and it was peculiarly appropriate that when his son, George, brought it to America, in 1875, he should proceed to improve upon it and to make it practical for American manufacturers.

It was about 1870 that the famous Crompton gingham loom appeared, with the well-known Wyman box motion attached to it. This soon became the standard fancy cotton loom of the United States.

George Crompton's improved fancy woolen loom marked an era in the annals of that industry. In 1850 the William Crompton looms threw the shuttle fifty times per minute, and by 1876 George Crompton had increased the capacity to 180 times per minute, while production mounted 60% over the loom of 1850, with a saving of 50% in labor, and in excess of that figure in repairs.

At the Centennial Exposition in 1876, his exhibit of a broad fancy loom, a broad woolen loom, a narrow loom with a new box motion, a pick-finder operated by power, and his gingham loom, which became the standard mechanism of the United States, brought to him an award "for

the best looms for fancy weaving on shawls, cassimeres and satinets, embracing original invention, ingenious construction and excellent workmanship."

HE FORMS THE CROMPTON CARPET COMPANY

It was but natural that George Crompton, whose mind was so filled with improvements on looms, should have become interested in developing one for weaving Brussels carpets by power, and, in 1870, in association with a group of Worcester capitalists, he formed the Crompton Carpet Company, which was the predecessor of the local mills now owned and operated by the M. J. Whittall Associates. The late Matthew J. Whittall was Mr. Crompton's first superintendent in the carpet plant, and later bought the business. George Crompton also owned and operated the Packachoag Mill until it was destroyed by fire in 1884.

For many years he was a director of the Worcester National Bank and of the Worcester Gas Light Company, and he became one of the founders of the Hartford Steam Boiler Insurance Company. The first to suggest the formation of this useful agency, he was given the initial policy issued by it.

In 1881, Mr. Crompton established the Star Foundry on Washington Street, which he conducted successfully, in addition to the large foundry connected with his own loom works, the capacity of which was found to be inadequate in periods of rush production. The loom works which he operated under his own name from 1859 to his death, in 1886, housed many of America's great mechanics of later years. It was here they began their experience and here that they gained the skill and knowledge which in after years placed them above their fellows. Among the famous inventors in the employ of Mr. Crompton was Henry C. Leland, of Detroit, Michigan, famous as the designer of the Cadillac motor and of the first commercial car to be equipped with electric lamps and a self-starter, and also the designer of a later model of the same automobile—the first to be made commercially successful—with a V-shaped motor.

George Crompton's more than one hundred patented inventions, most of which were connected with looms, included ramifications into fields far remote from the textile art. He was one of the first, if not the first, to conceive the invention of the time lock for safes, and singularly enough the idea of this device was advanced by him following the robbery of the Grafton National Bank, in 1870. The day after that episode occurred, Mr. Crompton met Mr. Cross, the vice president and cashier of the Worcester National Bank, and the latter said to him: "Mr. Crompton, you will probably sleep soundly in your bed tonight, and indefinitely in the future, but how about me and other bank men? How can I ever be sure, when I retire for the night, that I may not be awakened by a burglar holding a revolver at my head and ordering me to go down and open the safe, as the bank cashier was compelled to do last night in Grafton?" Mr. Crompton replied that he had been thinking the matter over, and that he could fix a safe lock so that no one could open it until a predetermined hour in the morning. He made a rough sketch and showed Mr. Cross just how this could be done. His inquisitor was very much impressed, and said, "I suppose you will patent this invention," but Mr. Crompton felt that he had no time to follow up inventions in fields other than that in which he was particularly interested.

Not only did he direct the affairs of his loom works, which toward the close of his life employed nearly 1,000 men, and operate a large foundry, but he was extremely interested in all matters pertaining to the welfare of the City of Worcester. For a number of years he served as councilman and alderman, and he took a prominent part in the introduction of the waters of Lynde Brook into the city, being chairman of the commission appointed to superintend the rebuilding of the dam, which had been destroyed by a flood. He was the Republican candidate for mayor in 1871, but was defeated, and he served as chairman of the Civilian Soldiers Monument Committee, it being chiefly through his efforts that Randolph Rogers was secured as the designer of the memorial. At its dedication, he made the presentation speech. He impressed all those with whom he came in contact as being a man of strong personality and great driving power. Though immersed in business and absorbed in his inventions and improvements, he was far from being unsociable, and was never happier than when entertaining his friends at his home.

He died December 29, 1886, and of the many tributes paid to the memory of the great inventor, one that appeared in the editorial columns of a local newspaper is particularly appropriate because of the somewhat unusual message it contained:

"There is a lesson to be drawn from Mr. Crompton's life and achievements—a lesson somewhat trite, but nevertheless needing constant reiterating and constant insistence—that honest and persistent work will win, and that success cannot be hoped for through any other channel or by any other means. Mr. Crompton was a worker—a man who was completely engrossed with the matter the accomplishment of which appealed immediately to him. He threw himself into whatever he undertook to do with a whole-hearted devotion which compelled success. Nothing of moment can be accomplished in this world by dilettanti. There must be devotion, vigor, the giving up of lesser matters, the crucifixion of all else in the interest of overpowering and compelling central motive, to assure success; and with such sacrifice of smaller hopes and ambitions, the larger is sure to attain success, if it be worthy."

Following Mr. Crompton's death, the Crompton Loom Works were operated for a year by his widow, Mrs. Mary C. Crompton, although the actual management devolved upon Horace Wyman, Justin A. Ware and John B. Syme.

In January, 1883, the concern was incorporated with capital of \$500,000, with Mrs. Crompton as president, Mr. Wyman as vice president and manager, and Mr. Ware, as secretary and treasurer. The board of directors included Mrs. Crompton, Mr. Wyman, Mr. Ware, Charles Crompton, and Isabel M. Crompton, the latter being the eldest daughter of George Crompton. In 1893, George Crompton, son of the inventor, was elected to the directorate, and three years later, Randolph Crompton, another son, was added to the board.

THE INVENTIONS OF CHARLES CROMPTON AND HORACE WYMAN

During the latter years of the life of George Crompton, Sr., he had devoted much time to the development of an improved pile fabric carpet loom, but at the time of his death the machine had not been perfected, and in the early nineties, his son, Charles, and Horace Wyman succeeded in producing such a mechanism. This loom, one of the largest, most com-

plicated and costly pieces of textile machinery ever manufactured, was sold in large quantities in this country and in England.

In 1895, Charles Crompton, son of George Crompton, Sr., and Mr. Wyman invented and patented the first fancy automatic bobbin-changing loom for weaving colors with multiple shuttles—a great advance in the development of weaving machinery. Charles Crompton held patents on various other devices. He began his business career with the Crompton Loom Works, holding various positions until 1896, when he succeeded his mother as president of the concern, and when the consolidation of the Crompton and Knowles units was effected, in 1897, he became vice president of the new corporation, practically retiring from active business in 1900, but devoting his efforts subsequently to the processes of loom manufacture.

The invention of the first fancy automatic loom was an absolutely new idea, in the art of weaving, no attempt previously having been made to develop such a piece of machinery.

In 1895, Messrs. Charles, George and Randolph Crompton, and Mr. Wyman inspected the Northrop automatic loom—the first commercially successful piece of machinery of its type, but not the first attempt along that line. For forty or fifty years, before, English inventors had been at work on the problem, but without success, and at the time they were attempting to produce an automatic loom by changing the filling while the loom was still in operation. Some were trying to produce a shuttle-changing loom, but nothing came of their experiments.

The Charles Crompton and Horace Wyman automatic gingham loom appeared a year after the initial marketing of the Northrop automatic loom, and during the next five years refinement and alteration materially improved this type. The first looms turned out were equipped with circular revolving magazines, from which the bobbins were arranged in such an order that the machines always took yarn of the proper color. That form of magazine was later discarded in favor of a vertical stationary magazine, provided with a separate section for each color of weft yarn, and the original electrical detector was largely superseded by a mechanical detector which feels the amount of thread on the bobbin at each passage of the shuttle, and when a bobbin is nearly depleted another of the same color is automatically selected from the magazine.

Because it cannot always be introduced immediately into the shuttle, since the pattern may demand a shuttle from another box for the next pick, the selected bobbin is held in suspense until the shuttle for which it is intended again comes into action. The parts work in such unison and precision that a fresh bobbin cannot be placed in the wrong shuttle.

Solving the difficulties peculiar to an automatic drop-box loom such as that of the gingham type was an achievement of the first order, and the contribution made by Messrs. Charles Crompton and Horace Wyman indicated beyond dispute that the history of the power loom of the nineteenth century was repeated by the automatic loom of the twentieth century.

RANDOLPH CROMPTON'S SHUTTLE-CHANGING LOOM

It remained for Randolph Crompton to invent and patent in 1895, the first successful and practical shuttle-changing loom, and due largely to his efforts the Crompton Loom Works that year acquired some inventions in

connection with lappet weaving, and in 1896 marketed large numbers of lappet looms and motions.

Thousands of the Randolph Crompton shuttle-changing looms were installed in the years succeeding the invention, and many of this type are still made.

HARRY WORCESTER SMITH'S INVENTIONS

In 1897, 1898, and 1899, Harry Worcester Smith, son-in-law of George Crompton, Sr., contributed important inventions and improvements to the Charles Crompton-Horace Wyman fancy automatic bobbin-changing loom, which made for increased efficiency, and altogether he was granted thirty patents on automatic color weaving during these years. His inventions revolutionized the manufacture of gingham, or drop-box fabrics, in the United States and Europe. These were sold or leased to the Crompton & Knowles Loom Works, and to the Draper Corporation, and Mr. Smith was the recipient of large royalties.

It was in 1895 that court litigation was instituted by the Crompton concern against the Knowles Loom Works for certain alleged infringements of patents, but before they reached trial the merger of the two units was effected under the name of the Crompton and Knowles Loom Works.

THE FORMATION OF THE CROMPTON & KNOWLES LOOM WORKS

In 1897, upon the formation of the Crompton & Knowles Loom Works, George Crompton, Jr., was elected treasurer and a director of the corporation, from which position he resigned in 1900, when the Crompton interests in the works were acquired by the corporation. In 1900 he entered into a partnership with Edward D. Thayer, William B. Scofield, and his brother, Randolph Crompton, and under the name of the Crompton-Thayer Loom Company, the manufacture of looms was commenced. In 1907 this company was sold to the Crompton & Knowles Loom Works, and George Crompton, Jr., again became a director of the latter concern, and still serves in that capacity. In 1912, upon the consolidation of the F. E. Reed Company and the Prentice Brothers' Company, both manufacturers of machine tools, into the Reed-Prentice Company, Mr. Crompton was elected treasurer and director of the new corporation, from which positions he resigned on January 1, 1916.

Randolph Crompton became assistant superintendent of the Crompton & Knowles Loom Works, at the time of the merger, and directing head of the Green Street plant, later becoming vice president of the corporation, a position he held until he resigned, in 1900. He was the chief executive and general manager of the Crompton-Thayer Loom Company from its formation until it was sold to the Crompton & Knowles Loom Works, in 1907. In 1918, he became associated with the Mason Machine Company, and was in charge of the loom department of this concern until 1924, when he became manager of the fancy loom department of the Hope-dale Manufacturing Company, and remained with that concern until its consolidation with the Draper Company in 1927.

SOME OF GEORGE CROMPTON, SENIOR'S, COLLABORATORS

The senior George Crompton possessed the happy faculty of attracting to him inventive geniuses, and among his collaborators in the development

of the weaving art none was of greater help to him than Horace Wyman, a native of Woburn, where he was born, November 27, 1827, a descendant of John Wyman, who emigrated to this country, in 1640, from West Mill, Herts County, England, and who became one of the founders of Woburn.

Horace Wyman was educated in the public schools of Woburn, at Warren Academy in that city, and at Francestown, N. H., Academy. In 1848 he entered the employ of the Amoskeag Manufacturing Company, of Manchester, N. H., leaving his position there to become draughtsman for the Hadley Falls Company of Holyoke.

In 1859 he became superintendent of the Crompton Loom Works, and upon the incorporation of the concern he was chosen vice president and general manager, holding these positions until the consolidation of the Crompton and the Knowles Loom Works in 1897, at which time he became the consulting engineer of the new corporation.

Mr. Wyman was the inventor of the American gingham box motion—the standard cotton box motion of this country. He was also co-inventor and improver with George Crompton, Sr., of the Keighly dobby, which frequently was called the New England dobby. Thousands of these mechanisms are now in use in this country. He also was associated with George Crompton, Sr., in the construction of carpet looms, and after the latter's death developed the famous Crompton-Axminster loom. In 1895, with Charles Crompton, he invented the automatic fancy cotton loom, and was instrumental in perfecting it. He received no less than 213 patents on feeders and magazines, devoting the latter part of his life almost exclusively to the perfection of this loom. He died May 8, 1915.

Albert A. Gordon, Sr., another associate of the senior George Crompton, was born January 30, 1836, in Farmington, Maine, and became connected with the Crompton Loom Works, in 1859. His long career, extending from the time the concern was but eight years old, to September, 1916, when the Crompton Loom Works had been consolidated with the Knowles Loom Works for nearly twenty years, covers an important period in the history of American weaving machinery. He brought about many improvements in the manufacture of looms, one of the most important of which was in connection with the chain rolls for the pattern chain. In 1860, narrow rolls were cast on tubes of the proper width, and in this way half the weight of the rolls in the building of the chains was eliminated. Subsequent to the appearance of this type of roll, wooden rolls of lignum-vitae were developed which proved ideal for the purpose, but the cost was almost prohibitive. The next development was that of the cast rolls with the patterns carefully made and gauged to produce such rolls in large quantities and of a minimum weight. Instead of being cast on tubes, these rolls were made solid and then drilled, the outside diameter being ground to size. The next development was the regular turned cast iron roll which has recently been superseded by the machine-steel roll. It was with Mr. Gordon's aid that George Crompton, Sr., produced the first malleable iron shuttle boxes, which previously had been made of cast iron. Mr. Gordon obtained and assigned several valuable patents to the loom works, prior to his death on November 18, 1922.*

*The author acknowledges his indebtedness to Mr. George Crompton, son of the late George Crompton, Sr., and grandson of William Crompton, for much of the data concerning the inventions of the Messrs. Crompton.

THE KNOWLES LOOM WORKS

Lucius J. and Francis B. Knowles were born on a farm in the little town of Hardwick, in Worcester County. The former devoted all of his spare time to mechanical work, and before he sold his interest in a Shrewsbury grocery store, he had completed a working model of the famous Knowles safety steam boiler feed regulator. Later, he became interested in developing electric motors and photography, and in 1844, upon inventing a spooling machine, located in Worcester as a thread manufacturer. In 1846, he started a cotton warp mill in Spencer, removing the business to Warren three years later. From 1855 to 1860, he manufactured satinetts there, securing two patents for looms during that period, and one for an improved pumping engine valve. In 1862 he built a machine shop, where his patent feed regulator was manufactured, and the following year he started the production of steam pumps, in Warren, entering partnership with Simeon H. Sibley, under the firm name of Knowles & Sibley.

The Knowles steam pump was a highly useful piece of apparatus, of enormous benefit to contractors and miners, ranking almost as important as the Knowles loom, as an invention, and it is another enduring monument to the skill and ability of Lucius J. Knowles. The pump works became an important industry in Warren, and it was while carrying on this business that Mr. Knowles' attention was called to fancy looms. He patented his first loom in 1856, this grant covering the camjack harness, followed in 1857 by another covering drop-box mechanism, which marked the beginning of the principle upon which the operation of the Knowles head and side plate box motion is based. He made many other useful and valuable inventions along many different lines. However, most of them relate to looms and steam pumps and these are curiously intermingled.

Both lines were started about the same time and were carried along together for many years. Mr. Knowles frequently asserted that it was much easier to follow two different lines of invention at the same time, than to keep one's mind constantly on one particular subject.

His brother, Francis B., who was a born trader, and who early became interested in salesmanship, later engaged in the manufacture of men's clothing, and during the early years of the Civil War was the recipient of government contracts for army gloves. It was in 1862 that the two brothers formed the firm of L. J. Knowles & Bro., and began producing looms, in Warren.

The versatility of Francis B. Knowles is shown by the fact that between 1856 and 1862 he received no less than fourteen patents on looms; on shuttle motions, three covering safety indicators for steam boilers; on an improved shuttle; on an improved faucet; on a belt shifter for machinery; on a steam pressure regulator; on a lifting jack; on an improved method of operating valves for pumping engines; on a safety feed apparatus for steam boilers, and on an apparatus for operating valves for steam engines.

From 1859 to 1861 Mr. Knowles improved the box motion of 1856 and 1857 by placing it at one end of the loom, doing away with pulley and cord connections and using compound levers and solid connections and combining it with a new *open shed* harness motion made along the same

lines as the new box motion principle, whereby the harnesses were operated by cranks in the same manner as the boxes.

MR. KNOWLES INVENTS A FANCY LOOM OF OPEN SHED TYPE

On February 24, 1863, he was granted his first patent on a fancy casimere loom of the open shed type in distinction from the closed shed loom then generally in use. It was capable of weaving checks and figured fabrics, and employed cranks and toothed crank wheels, in connection with revolving lifter and depression wheels, so arranged and operated as to disperse with the cam, thus permitting operation with greater economy of time and power. He subsequently adapted his loom to the weaving of many new fabrics, of cotton, wool and silk, tapes, ribbons, webbing, galloons, suspenders with woven button-holes, Marseilles quilts and other products.

This *open shed* fancy loom was quite different from the loom patented in 1856. The harness chain in this device runs intermittently, instead of constantly, and the harness motion is open shed instead of close shed, as in the 1856 patent. Mr. Knowles was not the first to make an open shed loom. Quite a number of fancy looms on the open shed principle were in operation as early as 1860, but most of the fancy looms in common use at the time Mr. Knowles was ready to introduce his new loom (in 1873) were close shed. In a close shed loom all of the harnesses come to the center every pick. In an open shed loom only those harnesses that are required for the next pick change positions. A pick and pick loom is a loom so arranged that two or more shuttles may follow each other from either side of the loom. The harness motion referred to was subjected to many changes and experiments and was in 1862 put into use making fancy tapes for hoop skirts and for making a variety of webbings. A large number of looms were built with this harness motion, but only two with harness and box motion combined.

On March 20, 1866, Mr. Knowles received a patent on mechanism for obtaining an intermittent rotary motion for tape loom shuttle motion, and on May 15th, another on a positive shuttle motion for narrow ware looms. On November 13, a patent was awarded him covering a cam harness motion, and on December 11, one on shuttle motion, both for narrow ware looms. That same year the firm removed to Worcester, where it continued to manufacture looms and steam apparatus, as well as other patented inventions made by L. J. Knowles.

The concern did not manufacture the harness and box motion patented in 1863 on account of being threatened with a lawsuit if it attempted to make an open shed fancy loom, George Crompton having control of the Moses Marshall patent on open shed looms. Mr. Knowles was aware the narrow ware loom he was making was an open shed loom, but by refraining from building an open shed fancy woolen loom, he hoped to be free from prosecution. In 1868 the Moses Marshall patent was defeated in a suit against the S. T. Thomas open shed loom, and about this time two fancy cotton looms were built by the Messrs. Knowles along the lines of the 1863 patent.

In 1868, L. J. Knowles & Bro. began to make these looms with drop boxes at each end, thereby making it possible to use different colors of filling for checks and plaids, and in 1871 the firm produced these drop-box looms, with chain or fancy harness motion, out of which grew the

fancy woolen loom of the present type, the first being installed in the Jamesville Mills, in Worcester, in 1872.

Patents followed thick and fast during the next few years, thirteen being received by Mr. Knowles between August 27, 1867, and September 12, 1871, covering looms, stop motions, a piston for a steam pump, piston packing, a valve for steam and other pumps, belt shifting mechanism for looms, shuttle box motion, and four covering steam pumps. About 400 looms were built by the concern in 1869 and 1870, and in 1873 it patented and sold its first fancy woolen loom. Lockwood, Greene & Company designed new shops for the company, which were erected in 1870. At that time they were the largest structures in the United States devoted to the manufacture of fancy looms, and had a capacity of producing fifteen looms daily.

In February, 1873, when George F. Hutchins entered the employ of the concern to assist L. J. Knowles in the development and improvement of his new loom, about thirty hands were employed, and tape and satinet looms, cloth presses, boiler feed apparatus, jack screws, steam pump cylinder heads, and a variety of other machines, constituted the products.

Mr. Hutchins was of material assistance to L. J. Knowles, and during the years he was associated with the original and successive concerns he was granted nearly 100 patents pertaining to looms, which he assigned to the company. He remained with the original firm for eleven years, became general superintendent of the Knowles Loom Works, when it was organized in 1885, and retained that position with the Crompton & Knowles Loom Works from its organization, in 1897, to his resignation, in 1917.

Numerous patents were granted to L. J. Knowles in the '70s, the most important of which was that issued on January 21, 1873, which was the foundation patent of the Knowles loom of today, and the first broad loom of this type. An extensive exhibit was made at the Philadelphia centennial, in 1876, including a forty harness loom. Three years later L. J. Knowles disposed of his steam pump works, in Warren, to the G. F. Blake Manufacturing Company.

In 1880, L. J. Knowles & Bro. removed to a new shop, on Junction Street, occupying at first 44,200 square feet, which area was soon increased to 84,000 square feet.

Patent after patent followed in the '80s, and the "Little Gem" loom, and the Gem silk loom were introduced to the trade. An agreement was made that year with an English firm to build and sell the Knowles loom in England, and on the Continent. Lucius J. Knowles died on February 24, 1884, and Francis B. Knowles continued operations under the original firm name until January 1, 1885, when the Knowles Loom Works were incorporated, and he became president, which position he held until his death.

In 1884 a new loom for weaving worsteds was introduced, which became the standard among all manufacturers a year later. It was of the heavy type and of thirty harness capacity, and the company built and delivered what at that period was the largest number of looms on a single order ever turned out by an American concern, 204 of these products being installed in the Riverside and Oswego Mills, in Providence, R. I. Looms for weaving silk ribbons, suspenders, bindings, all types of narrow goods, flannels, dress goods, fancy cotton, grosgrains, satins, plain and

fancy silk goods, upholstery fabrics, portieres, draperies, silk velvets, silk plushes, mohairs, and ingrain carpets were designed, patented, and manufactured during the next few years, including what at that period was probably the widest loom for fly shuttles ever made, with a reed space of 236 inches.

In 1889 the intermediate worsted loom was placed on the market, and that year a new foundry containing 35,120 square feet of space, and a new machine shop, with 179,700 square feet, were erected.

Francis B. Knowles died May 18, 1890, and C. H. Hutchins succeeded him as president of the corporation.

In 1893 when the concern decided to build dobby and jacquard looms it purchased the plant of George W. Stafford & Company, of Providence, R. I., where operations were carried on, new types of jacquards brought out and notable improvements made, with the result that a majority of these looms used in this country are made at this unit.

In 1896 work was begun at the Worcester plant on an automatic loom, the first of a change shuttle worsted type being installed in the Wanshuck Mills.

GROWTH OF THE CROMPTON & KNOWLES LOOM WORKS

The next year came the consolidation of the Crompton Loom Works and the Knowles Loom Works, under the name of Crompton & Knowles Loom Works. In 1899, an extension was built to the main shop, adding 13,920 square feet, and the same year the purchase of the Gilbert Loom Works was effected, which gave the new corporation the nucleus of the tapestry carpet loom. The Crompton & Knowles Loom Works had been building several kinds of carpet looms, but up to that time had not entered the tapestry field. Charles W. Gilbert was one of the pioneer loom manufacturers of Worcester, having begun business in 1865. He remained with the Crompton & Knowles Loom Works as manager of the Gilbert loom department, until 1906.

In 1900 the interests of the Crompton family were acquired by the corporation, and in 1902 the Smyrna rug woven business of the M. A. Furbush & Son Machine Company, of Philadelphia, was acquired, and was operated in that city, until 1915, when that unit was removed to Worcester, together with the plant which had been established in Philadelphia, in 1903, for building carpet looms, a new shop being erected at Worcester to take care of this type of production.

In 1904 the corporation installed its first gingham loom, with automatic bobbin changer, in the Lancaster Mills, at Clinton, and the following year a new power plant and wood working unit, containing 84,070 square feet, was built.

In 1906 the business of A. H. Steele & Brother, of Worcester, manufacturers of narrow ware looms and fittings for the same was bought, followed a year later by the purchase of the Crompton & Thayer Loom Works, of Worcester, which had been established four years before, to manufacture worsted, woolen, and silk looms, and later fancy cotton looms. In 1904, Edward D. Thayer, one of the partners of that concern, applied for a patent on a semi-automatic loom, in which the filling could be changed while the loom remained in operation, but with the assistance of the weaver.

In 1908 a new office building, containing 83,540 square feet, an addi-

tion to the foundry of 50,088 square feet, an extension to the machine shop, containing 40,176 square feet, and a store house, with 41,000 square feet of area, were erected.

An automatic worsted loom, similar in most respects to the company's heavy worsted loom, with the exception that the automatic magazine was attached and the worm take-up was made reversible, was placed on the market, in 1911, most of these new looms being motor driven.

In 1913 a fifth floor was added to the main plant, affording 37,500 more square feet of area, and a new machine shop, containing 42,400 square feet, and a garage, of 1,450 square feet, were built. Three years later the foundry was enlarged by the addition of 24,450 square feet.

In 1917 C. H. Hutchins resigned as president, and George F. Hutchins resigned as general superintendent, these changes being voluntary. Lucius J. Knowles was chosen president, and John F. Tinsley, general manager.

The Messrs. Hutchins had seen the business grow from small beginnings to the largest loom manufacturing corporation in the world, and from a concern producing one loom to more than one hundred types, while the three plants contained on January 1, 1917, 909,081 square feet, or about 20.8 acres of manufacturing space. The corporation then owned 965 patents relating to looms. By December, 1927, this total had risen to 1,390.

William Wattie, who for thirty years was superintendent of the plant, was granted upwards of sixty patents, all of which were assigned to the corporation. All but one were designed to facilitate the construction of looms, to simplify and perfect them, to increase their efficiency and to widen the scope of patterns.

Eppa H. Ryan, who became connected with the corporation in 1900, has received and assigned to the concern upwards of 100 patents, many of them devoted to improvements on automatic looms, and to the development of the dobby type.

Benjamin F. McGuinness, for many years head of the company's weaving department, has been issued patents on upwards of thirty mechanical devices, all being assigned to the corporation, the most important being a counter-stop motion, now in general use.

In July, 1920, the company purchased land for the Knowles Recreation Park, and that year Homer Gage was chosen president of the corporation, following the death of Lucius J. Knowles, in London, on November 26, 1919.*

Warehouses are maintained in Worcester, Charlotte, N. C., and Philadelphia, and branch sales offices in Allentown, Pa., Charlotte, N. C., Paterson, N. J., Philadelphia, and Providence.

The capacity of the Worcester and Providence plants is such that a finished loom is turned out every ten minutes of each working day, and it is the boast of the corporation that it can produce a loom for every woven fabric, no less than 160 different types of automatic and non-automatic looms being produced for weaving fabrics from the sheerest of lawns to the heaviest of carpets.

The plants now occupy twenty-six acres of manufacturing space, and

*The facts applying to the inventions of Lucius J. Knowles were provided by Mr. George F. Hutchins, of Worcester, who was associated with the inventor for many years, and the author acknowledges his appreciation of the assistance rendered by the former general superintendent of the Crompton & Knowles Loom Works.

the story of this corporation is but added evidence that age has not withered its development, but rather spurred it on to new mechanical successes until it commands the world market in the production of a wider range of looms than any other concern.

It has capital of \$11,000,000 and employs upwards of 3,500 men and women.

Dr. Homer Gage is president, John F. Tinsley, vice president and general manager, Frederic W. Howe and Irving F. Verry, vice presidents, Edward F. Green, treasurer, and Fred J. Bowen, clerk and assistant treasurer.

Draper Ruggles, Joel Nourse and John C. Mason, of Worcester, as the assignees of E. G. Matthews, patented in 1840, machinery for hewing plough beams, and made valuable improvements in cast iron and other types of ploughs, of which they became extensive producers.

THE WILLIAMS & BRIDGES COMPANY

In 1840, I. N. Keyes founded the present-day Williams & Bridges Company and for fifty-six years remained at its head. In 1896, George A. and W. K. Williams, purchased the Keyes plant, and operated it under the name of Williams Brothers. A year later, Granby A. Bridges became a member of the firm, and in 1904, the Williams & Bridges Company was incorporated. In 1889, a branch factory was established, at Hopkinton, which, in 1910, was removed to Framingham, the two units now employing 150 hands.

The corporation has capital of \$30,000. F. H. Claflin is president and treasurer, and C. F. Claflin, is secretary.

THE COES WRENCH COMPANY

Two observant brothers, Loring and A. G. Coes, both natives of Worcester, while working as pattern makers in a Springfield foundry, produced the model of a new and improved form of wrench. At that time there were two styles of wrenches—one of English invention, and the other, the Merrick, a Springfield type, but both required the use of the two hands of a mechanic to open and close them.

It occurred to the Messrs. Coe that the screw on the shaft could be dispensed with, as on the Merrick product. They affixed to the side of the shaft a small bar in the form of a screw, which entered another screw in the lower or movable jaw of the wrench, and added a rosette at the lower end of the first screw, where it entered the handle, the rosette being at all times within the reach of the thumb of the hand that held the wrench. This rosette, being turned by the thumb operated the screw, and the opening or closing of the wrench was effected by one hand, and, in addition, by removing the indentations from the bar or shaft, a stronger wrench was secured.

Returning to Worcester, Loring Coes secured a patent on April 16, 1841, and with his brother formed the L. & A. G. Coes Wrench Company. Lacking capital they found difficulty in procuring the malleable iron requisite to produce the original sample. Finally they were able to place a few wrenches on the market, and, by 1845, they purchased an idle woolen mill in Worcester, 100 by 35 feet, which was subsequently doubled in size. Next they erected a blacksmith shop, 75 by 50 feet, in which, with the aid of machinery, they reached a production of 10,000 wrenches a week and

employed fifty hands, in 1860. They invented and patented a machine to bear the wrench-blanks, and another for holding a wrench on a grindstone in such a manner as to wear the stone evenly.

On July 6, 1880, and again on July 8, 1884, patents on improvements on the original wrench were granted, and in 1881 the Coes Wrench Company was incorporated, with capital of \$100,000, which later was increased to \$150,000. In 1888, the firm of L. Coes & Company, then engaged in manufacturing shear blades, was merged with the wrench unit.

In 1928 the assets of the Coes Wrench Company were acquired by the Bemis & Call Company of Springfield, producers of the Merrick wrench, almost ninety years after the Worcester inventors began producing the Coes product.

WORCESTER'S ADAM OF THE HORSELESS AGE

There are claimants galore for the honor of having produced the first vehicle to operate on the highways of America, by power other than that furnished by a beast of burden, and while history shows that inventive minds had been at work on the problem decades before the advent of the first practical automobiles of the '90s, the city of Worcester may very properly lay claim to having had one of her sons contrive one of the first horseless carriages, as early as 1843.

Three years before that date, John B. Edwards arrived in Worcester, and entered the employ of Messrs. Goddard and Rice, at the princely wage of \$1.75 per day—a figure regarded as quite unusual, even for one of his attainments in the scientific and industrial worlds of that era.

As a lad, he had been in charge of the controls of the steamboat *Commodore Preble*, a long, narrow craft that raced between Boston and New York trying to beat the trains of that period.

In his spare evening hours he studied steam transportation, and addressed himself to the problem of evolving a practical vehicle capable of operating by steam upon the highway, and which would not require the use of flanged wheels and trackage.

History is to the effect that Edwards became so immersed in his experimental work that the evenings frequently wore along until the wee small hours of the morning before he was willing to relinquish his quest for the solution of the engineering problem which so obsessed him.

By 1842 he had his plan drawn for an automobile, and started to build the machine. From the William A. Wheeler foundry he obtained his iron wheels, fitted with iron spokes and at the Goddard & Rice shops he built the frame and set his three wheels—for his design was that of a horseless tricycle—ready for the machinery.

The factor of gearing by means of chains and sprocket wheels was unknown at that period, and Mr. Edwards could evolve no other way than to attach the piston direct to a cranked rear axle, after the fashion of a locomotive.

To insure an upright position, he hung the boiler, equipped with six flues, on a pivot. It was the day of steam and as there was no power-producing agency such as gasoline, naphtha, or other combustible, he first attempted to install six small lamps, equipped with petticoats, but as they failed on trial to produce steam fast enough, Mr. Edwards finally turned to coal. He constructed a large apron which provided forced draught, and at last steam was produced, and the little engine began to

function. He hid the one and one-half horse-power motor, as well as the boiler and firebox, under metal sheathing, and when his tricycle was completed it weighed no more than the average four-wheeled buggy of that period. The motive power was applied to the rear wheels, while the front wheel served to guide the machine, a lever of practically the identical design and operation that was applied to the automobile prior to the introduction of the steering wheel of today, being installed on Mr. Edwards' original machine.

With righteous pride, the inventor sallied forth to demonstrate to a gaping populace the revolutionary invention of his brain. But the citizens of Worcester were a quiet, peace-loving people, and they were sorely distressed as they saw and heard this roaring contraption moving up and down the arteries of traffic. The terrified horses, hens, and chickens were quite as vocal as were the men, women and children who, with loud squawkings, ambled to safety, whenever Edwards and his bellowing steam carriage hove in sight. The ubiquitous and arrogant town constable, Fred Warren, entered the picture at this point, and banished the inventor to his own back yard, and to the country roads.

Mr. Edwards, at that time had entered the employ of the Graton & Knight Company. Learning through the medium of local gossip that his fellow citizens considered him to be nothing short of a dangerous lunatic, and his invention a contrivance instituted of the devil, he endeavored to assuage their fears by smothering the exhaust and by eliminating the roar of the engine. After his third essay on Main Street, where he operated the machine from the Old South Church to the Salisbury Mansion, at Lincoln Square, and following a final warning from the authoritative minion of the law to the effect that if he again appeared on the streets of Worcester with the contraption he would suffer arrest, Mr. Edwards became discouraged and he parked the vehicle in the back yard at his home, having committed no greater sin than that of enjoying a few trial spins in his own horseless carriage.

While John S. Edwards had adapted the principle of the railroad locomotive to a self-propelling highway vehicle, American inventors were slow in appreciating the revolutionizing prospect of his discovery. True it was that his experiment was made some fifteen or more years after Thomas Blanchard had operated on the streets of Springfield his famous, but primitive, steam carriage, which met with a reception not unlike that accorded the Edwards vehicle.

French inventors seized upon the basic ideas of the Blanchard and Edwards products, experimented further, and worked them out to a solution no more advanced than that attained by the Springfield and Worcester men twenty or thirty years before. Paris engineers produced an electric automobile after sidetracking the steam device, and while it worked admirably, there arose valid objections to its practical use, and after a dozen years of wasted experiments foreign inventors again turned to steam as the proper motive power to operate a horseless vehicle.

In all its essential features, the steam automobile produced at the end of the last century was scarcely an iota different from the original machines of Blanchard and Edwards. The latter served his country during the Civil War, and, toward the end of the nineteenth century, retired to a small farm, in Leicester, where his horseless carriage became a mechan-

ical toy for his twelve children, each of whom took turns playing with the detached wheels and the parts of the engine.

James E. Fenner, now living in Rochdale, and the last surviving Grand Army veteran, in the town of Leicester, examined the Edwards engine many times before the vehicle was reduced to scrap, and he is firm in the belief that the credit of the first automobile should have been accorded to the Worcester inventor.

Possibly if Mr. Edwards had been less sensitive to the criticisms of his fellow-citizens, and had he possessed the financial means to persevere in the work which he believed was epoch-making, Worcester might have become the first center of the automotive industry, but having tested his machine, the urge of the inventor who was a dreamer, rather than a business man, appeared to be satisfied. He lived long enough to see his basic ideas, in the hands of others, acclaimed as one of the greatest achievements of the nineteenth century, and with the balm that this fact gave to his wounded spirit, he was content.

TIMOTHY K. EARLE & COMPANY

In 1843, Timothy K. Earle & Company of Leicester removed to Worcester, and continued in the production of machine-cards, erecting, in 1857, a factory which for many years was the largest of its kind in the country. Owning a number of patents on improvements in the method of producing card-clothing, the concern made all kinds, using both oak and hemlock tanned leather, manufactured upwards of ten varieties of cloth clothing, curried their own leather, and produced card-cloths and rubber-faced card cloths for themselves and for other card-makers. They built practically all their card-setting machines in their own machine shop, and manufactured double and single coon cloth for the foundation of card-clothing, providing special and improved machinery for the purpose. In 1883, the concern built a factory for the manufacture of all kinds of card-cloth, including vulcanized rubber facings.

ASHWORTH BROS., INC.

The American Card Clothing Company, now a branch of Ashworth Bros., Inc., producing card clothing, at its plant on Shrewsbury Street, where fifty hands are employed, under James Leigh, as local manager, is the successor of T. K. Earle & Company, and of the Sargent Card Clothing Company, which was organized in 1868 by Joseph B. and Edward Sargent, sons of Joseph B. Sargent, the famous Leicester manufacturer of card clothing, and which concern built a plant on Southbridge Street, now occupied by the Queensberry Mills. These two concerns were acquired by the American Card Clothing Company in 1890 at the time that corporation bought all the card-clothing concerns then doing business in the United States, with the exception of the Howard Brothers Manufacturing Company and of Charles F. Kent. About a dozen years later, the latter, who had begun business in Worcester, in 1880, disposed of his business to the American unit, which maintained its main headquarters in the city, until 1905, when it was liquidated.

WOOD, LIGHT & COMPANY

Wood, Light & Company succeeded Woodburn, Light & Company, who commenced business in 1846 in Worcester, six years later. Mr. Woodburn, on account of failing health, retired from the latter concern, and

Messrs. Charles Wood and J. F. Light succeeded to the business. They occupied a three-story building, 400 feet long, with a large blacksmith shop attached, near the junction of four important railroads, and manufactured engine and hand lathes, power and hand planers, slabbing machines, upright drills, boring mills, rotary cloth presses and fulling mills and gearing and shafting of all descriptions. Both being ingenious mechanics, they applied distinctive features and novel devices to their products, originating the arrangement in lathes, for changing the motion of the screw from the right to the left hand, by the use of three gears upon



AURIN WOOD
of Worcester

Who, in 1852, founded the machinery concern of Wood, Light & Company of Worcester, and who was a noted inventor

a plate inside the hand-stock, with the hub of the plate running through the stock, on which was fastened an arm or lever with an index pin attached. They also made an important improvement in the friction feed of lathes, designed to supersede the chain feed formerly employed, and Mr. Wood invented and patented a self-oiling attachment designed to keep the journal lubricated at all times, and also an improved lathe for turning shafting.

During the Civil War period the firm engaged in the construction of gun barrel machinery and profile machines. The firm's edging machines found their way into the European markets in the '60s.

THE ETHAN ALLEN COMPANY

From 1832, when Ethan Allen began the manufacture of the Lambert cane gun, in Grafton, until his death in Worcester, in 1871, where he had carried on the production of fire-arms from 1847 forward, no man in the world made a greater contribution in improvements and in the invention of machinery in the fire-arms field than this ingenious mechanic. In 1834 Mr. Allen began the production of the saw-handle target rifle pistol, which was soon followed by the self-cocking revolver, a product that was extensively used in the Mexican War, and by the Forty-Niners in California.

In 1847 he removed to Worcester, where he invented the double-barreled breech-loading sporting gun, and where he became the pioneer, in America, in the manufacture of double-barreled shotguns and fowling pieces. Probably he was the first to use steel shells in connection with

such an arm. His firm was among the first to adopt the breech-loading system in place of the muzzle-loading type.

Neither in America nor in Europe were metallic cartridges made at that period, except by hand—a slow and tedious process. Allen invented and patented the first set of machinery ever built for the purpose of producing machine-made ammunition. The leading-machine, which, in 1889, was used by every manufacturer of metallic cartridges in the world, was his invention, and successfully stood the test of litigation designed to destroy his patent rights. Prior to the appearance of this machine, no one, so far as history records, had conceived of any process of forming the lead, except by spinning it upon a lathe.

The Ethan Allen Company exhibited a set of this machinery at the Centennial Exposition, in 1876, and nothing in the mechanical line attracted more attention. Probably no fire-arms manufacturer in the United States made so great a variety of products as this concern—from the whale bomb-lance to the cheap Fourth of July pistol, and every type of bombing piece.

In 1849 Howe, Chenery & Company were manufacturing in Worcester, the wood-planing machine which had been patented by Thomas E. Daniels in the late '30s.

NATHAN WASHBURN'S NOTABLE INVENTIONS

Those who bemoan the departure now and then of a cotton unit to the South, or the advent of a formidable Middle Western competitor in the shoe field may well examine the Worcester record, where for more than thirty years in the middle decades of the last century the manufacture of car wheels was a leading industry, and for a decade or more the largest single local industry in point of capital and workers employed, and in value of product.

Nathan Washburn, who had been an iron manufacturer in Fitchburg, and a producer of castings, at Rochester, N. Y., where, in 1847 he secured his first patent for an improved car wheel, removed to Worcester, in 1848, and formed a partnership, with E. A. Converse, under the firm name of Converse & Washburn, becoming the sole proprietor, in 1854. In 1849 he invented another improvement in car wheels, which he patented the following year, and which became widely known as Washburn's Patent Wheel. Noted for its excellence and superiority over the car wheels then generally in use, the firm soon increased its business to a remarkable degree.

In 1852, Mr. Washburn invented and patented another improved car wheel the manufacture of which was immediately begun, and by 1859 his firm was employing from 170 to 190 hands, and turning out forty tons of iron a day. In 1860, there was but one other established in New England carrying on railroad work of this character. The Washburn car wheel became universally popular, and \$500,000 capital was employed in the business, with from 220 to 240 men to whom were paid wages aggregating \$7,000 a month. The works covered four acres of ground, and in the foundry, 175 by 60 feet, forty car wheels and eight tons of machinery were cast daily. In the rolling mills, 250 rails, weighing forty tons, were rolled each working day, and four tons of tire for driving-wheels and twenty tons of bar or puddled iron were turned out each day.

In 1864, the concern became the Washburn Iron Company and that

year Mr. Washburn went to Europe and returned with the equipment for a small Bessemer plant of about one-ton capacity, which he practically built, but never completed. The next year he disposed of his interests to his associates and built the works later occupied by the Washburn Car Wheel Company, disposing of the business of producing car wheels to the Washburn Iron Company in 1866 and engaging in the production of steel tire car wheels, and later locomotive truck and tender wheels.

The Washburn Iron Company continued to re-roll iron rails until 1881, when the demand almost completely ceased by reason of the general use of Bessemer steel rails. That year the concern began the importation of steel blooms, and the following year commenced rolling steel rails. In 1883 it became known as the Worcester Steel Works and work was begun on a Bessemer steel plant, the first steel being turned out in June, 1884. Later, an open hearth furnace was installed, and, in 1888, two new trains of rolls were added, and modern heating furnaces were installed for the manufacture of merchant bars.

About 400 hands were employed, producing 230 tons daily, the products including rails for steam and horse railroads, blooms, billets and shapes, merchant bars and castings, but the business passed out of existence in the late '90s.

J. E. & W. G. WESSON

Worcester has been the seat of boot and shoe manufacture for almost a century and a quarter, and among those locally engaged in the industry was Joseph Walker, who came to the city, from Hopkinton, in 1843, where he had been one of the first to put on the bottoms of shoes with wooden pegs.

The oldest surviving local shoe firm is J. E. & W. G. Wesson, manufacturing men's and boys' shoes, employing fifty operatives, the successor to the enterprise founded by Rufus Wesson, Jr., who came to Worcester from Shrewsbury, in 1849, and who continued business until 1873. He was succeeded by his son, J. E. Wesson, who had started business alone, in 1868.

Today, W. G. Wesson is the sole proprietor of the firm, which maintains a Boston office at 173 Lincoln Street.

THE WHITCOMB-BLAISDELL MACHINE TOOL COMPANY

In 1849, Carter and Alonzo Whitcomb formed a partnership under the name of Carter Whitcomb & Company and began the manufacture of copying-presses—the first successful attempt to establish in this country the production of these commodities. Iron planers, shears and punching machines were added and eventually the concern became the Whitcomb Manufacturing Company, which, in 1905, was merged with the Whitcomb-Blaisdell Machine Tool Company when the business established in 1865 by Parritt Blaisdell was acquired, together with the assets of the Draper Machine Tool Company, which dated back to 1845, when S. C. Combs & Company began manufacturing. The assets of the Whitcomb Foundry Company were also acquired in the consolidation.

THE WORCESTER GAS LIGHT COMPANY

The Worcester Gas Light Company was formed on June 22, 1849, with capital of \$45,000, John W. Lincoln being chosen as its first president, and Warren Lazell, its first agent.

The company was incorporated in 1851. Today, it has capital of \$2,400,000, and employs 250 operatives. Paul B. Morgan is president of the corporation.

Some measure of the present-day activities of local manufacturers may be had from the experience of the company which delivers great quantities of its gas for use in processes requiring heat. It delivered to Worcester industries in 1927, 178,705,000 cubic feet of gas. In 1928, 255,375,000 cubic feet were consumed for similar purposes. The figures of the use of gas in the Worcester Works of the American Steel & Wire Company give an insight into the increase in the activities of this concern. In 1927 the corporation consumed 82,563,300 cubic feet of gas. In 1928 this total increased to 138,775,300 cubic feet. While a material part of this great increase was due to the installation of additional gas-burning equipment, the larger part was made necessary by greater manufacturing output.

The Gas Company's total product for all purposes in 1928 was 1,456,790,000 cubic feet. In 1927 it was 1,311,056,000 cubic feet, thus indicating a gain in one year of more than 11 per cent.

THE MASON-WORCESTER COMPANY

In 1849 Ellis Thayer began the local manufacture of brushes, and twenty years later he formed the firm of Thayer & Mason, and, in 1878, the junior partner, the late J. Fred Mason, became the owner of the business. He engaged in the production of brushes of all descriptions. In 1929 the assets of the Worcester Brush & Scraper Company were acquired and the concern now operates as the Mason-Worcester Company, and is owned and controlled by descendants of J. Fred Mason. Sydney R. Mason is president, Edgar E. Sampson, vice president, Robert L. Mason, secretary, and Edward C. Buell, treasurer, the above with Hon. Edward F. Fletcher and Albert G. Mason, constituting the board of directors.

Thirty-five hands are employed at the Main Street factory, where brushes and mill supplies are manufactured.

WILLIAM H. BROWN—ONE OF WORCESTER'S GREAT INVENTORS

William H. Brown was long one of Worcester's most prolific inventors. Engaging in the machine shop business as early as 1850, Mr. Brown designed and made the first machines for manufacturing boot and shoe heels out of scrap leather, the patents being owned by Horace H. Bigelow. Mr. Brown designed a machine for winding baseballs, and constructed the first typewriter, from the design of Charles Thurber, the machine being preserved in the Worcester Society of Antiquity. It possessed a table for the paper, and operated by a ratchet lever for spacing. Above that was a revolving disc, which carried the dies of letters and numerals suspended on a small plunger. When in operation, the disc was revolved until the letter desired was in the proper place, and then the plunger was pressed down. At the finish of a line, the ratchet lever adjusted the paper for the next line. Mr. Brown later built a writing machine for the blind, similar to those in use today. It has been remodeled by Wm. H. DeLong, and is used by him in etching small tools. Brown was also the inventor of a portable bath device, and he designed and built a machine for the manufacture of milling cutters, taps and small gears, which was in use up to a dozen years ago. Mr. Brown also produced a variable dial to apply to

machines for cutting gears. During the Civil War he designed a breech-loading rifle, which is preserved in the Museum of the Worcester Society of Antiquity, and for many years he was engaged in the manufacture of carders' tools.

THE GRATON & KNIGHT COMPANY

In 1851, Henry C. Graton and Joseph A. Knight, as partners, established what today is the internationally known Graton & Knight Company, the first plant being a two-room shop, about 20 by 60 feet, while the original capital consisted of \$1,057.29.

As has been the case with so many large industries while in their embryonic stages, the entire working and administrative force for a time was composed of the two partners. After the day's work in the shop was done, Mr. Graton posted the books and struck a balance, while Mr. Knight attended to the correspondence. When business fell off, Mr. Graton, who is still alive, and unusually active and alert at 99 years of age, would forsake the currying table and the belt bench and go out in search of orders. He delights in telling of the "good old days," when he often traveled as far as thirty to fifty miles in a day, and frequently walked back to the little shop rather than trust to the uncertain train service. Naturally, the first sales were made to neighboring manufacturers, and all through the history of the company there has been on the part of its managers an effort to promote the development of the friendly, neighborly idea. It is interesting to note that the names of some of the original customers of the firm, secured by Mr. Graton himself, still appear on the books of the company.

Beginning operations in the card clothing factory, owned by Timothy K. Earle & Company, the business was soon moved to two rooms at 137 Front Street, and, in 1867, the firm began the manufacture of its leather in a tannery on Bloomingdale Road, which had a capacity of 150 hides a week.

The plant increased in size, making necessary a new location, and by 1870 the capital had been increased to about \$70,000; the yearly payroll then amounted to some \$25,000, and the annual sales totalled \$179,000.

The company was incorporated in 1872, with capital of \$100,000. In 1882, the Worcester Counter Company, a subsidiary, was formed, and carried on the manufacture of counters and soles, for shoes, in a building near the tannery. By 1890 the latter unit was tanning 600 hides a week. The first branch was established in Chicago, in 1893, and the same year a new factory was built, all operations being concentrated there five years later.

The concern weathered the succession of peaks and depressions in business, until the boom caused by the World War resulted in an almost doubled capacity and in expansion of the plant to meet the demand which ensued.

In the years from 1920 to 1922, in common with practically every other leather industry, the company suffered greatly from the post-war depression, primarily because of the necessarily long-time tanning process, and the deflation of hide values, which went in a very short time from 52c per pound down to about 10c. By careful management, however, it recovered much of this lost ground, in what has been characterized by a prominent banker as "one of the outstanding instances featuring the industrial come-

back of New England from 1922 to 1926." Today, about 1,200 employees are on the payroll, and 300,000 hides are tanned each year—principally for belting, though those parts of the hide which are not suited for such purposes are converted into hundreds of other mechanical leather products, such as automotive leathers, flat and V transmission belting, "Gold Spot" Spartan sole leather, counters, welting, insoles, lace leather, packings, oak sole leather, whole leather, textile leathers, and many other specialties.

The company originated the idea of Standardized Leather Belting, i. e., the application of perfectly standardized leather belting drives to all given conditions. Medals for excellence of products were awarded the company at the Louisiana Purchase Exposition in 1904; the Lewis & Clark Centennial Exposition in 1905; the Jamestown Tercentennial Exposition in 1907; the Alaska-Yukon-Pacific Exposition in 1909, and the Panama-Pacific International Exposition, in 1915.

The original capital of \$1,057.29 has grown to \$7,000,000, and the two employees of 1851 have increased to upwards of 1,500 today. Sales offices are maintained in Boston and Fall River. Frank H. Willard, a native of Harvard, in Worcester County, is president, Frederick E. Barth is vice president, Paul H. Wilson, is secretary, and C. A. Bartlett is treasurer, of the corporation.

THE INVENTIONS OF THOMAS H. DODGE

In 1851, Thomas H. Dodge, of Worcester, patented a rotary press, which really was the initial exponent of the new era of lightning presses by which blank paper is fed directly from the roll.

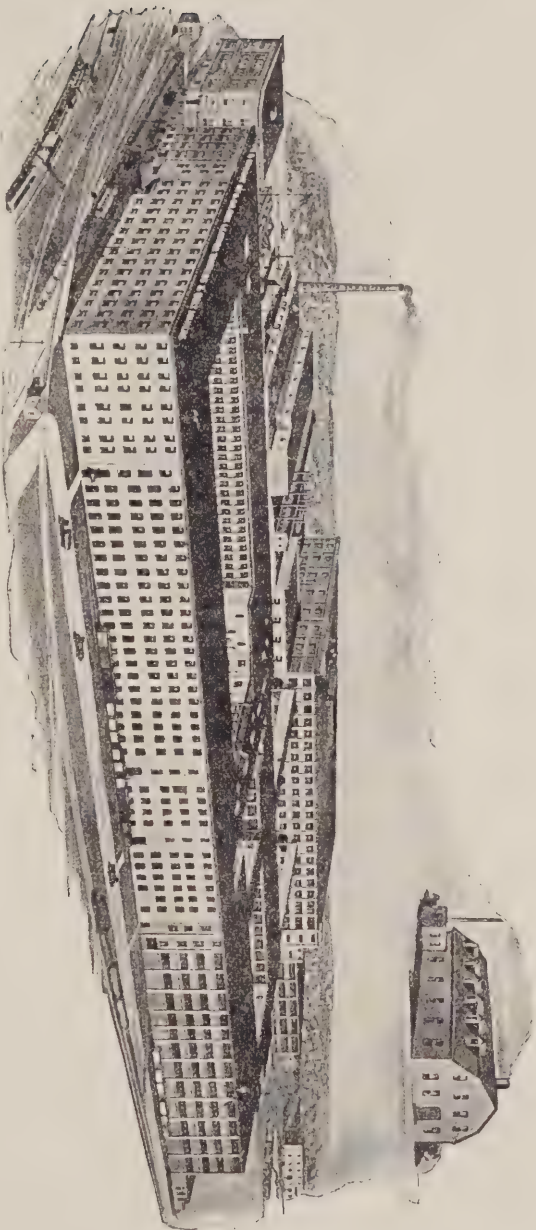
Mr. Dodge was also the inventor of the mechanism which enabled the driver of a hinged-bar mowing machine to control, from his seat, the entire cutting apparatus, lifting either end of the bar while the machine was in motion, a labor-saving device that has been applied to every mowing machine manufactured in the United States, since 1857 and which is reported to have saved on a single season of haying the services of 1,500,000 laborers.

In 1864, Mr. Dodge became identified with the Union Mowing Machine Company, of Worcester, and in 1881, with the late Hon. Charles G. Washburn, he organized the Worcester Barb Fence Company, being the co-inventor, and patentee, with Mr. Washburn of a four-pointed cable barbed wire which the company manufactured.

THE HEYWOOD BOOT & SHOE COMPANY

The largest local shoe manufacturing concern—the Heywood Boot & Shoe Company—today employing 400 operatives, in the production of quality men's shoes, really began business in 1853, when C. C. Houghton started manufacturing, the partnership of Houghton & Heywood being formed, in 1864. It was dissolved three years later, when Samuel R. Heywood began business in his own name, admitting Oscar Phillips to partnership nine years later. In 1884 the concern was incorporated under its present name. In 1894, 1905, 1907, and 1913, four large additions were made to the plant, more than doubling the floor space of the original factory, while gross business has increased several hundred per cent. At the beginning of this century the production of boots was abandoned, and since then only shoes have been manufactured. The present capital is

ORIGINAL AND PRESENT-DAY PLANTS OF THE GRATON & KNIGHT MANUFACTURING
COMPANY, WORCESTER



\$100,000, and Albert S. Heywood is president, B. S. Newell, vice president, secretary and treasurer, and Chester D. Heywood, assistant treasurer, of the corporation, which employs 400 operatives.

The high reputation of the Heywood shoe in footwear circles has been sustained for more than three quarters of a century, and the company's products have found a wider range of distribution as the years have passed, thus adding to the reputation of the Heart of the Commonwealth for the manufacture of quality commodities.

RICHARDSON, MERRIAM & CO.

In April, 1852, Horace A. Richardson, Rufus N. Merriam, William B. McIver, and Samuel F. Bond formed the firm of Richardson, Merriam & Company and began the manufacture of woodworking machinery. In 1864, Merriam was granted a patent on a new cutter arm for the Daniels



HORACE A. RICHARDSON
of Worcester
Who, in 1852, began the
manufacture of woodwork-
ing machinery, under the
firm name of Richardson,
Merriam & Company

planing machine, and in 1867, McIver secured a patent on expansive feed gearing for the Woodworth planer. The same year, Bond was granted a patent on a self-oiling journal box. The firm created and manufactured moulding machines, novel in design and construction and at one period employed seventy machinists.

THE INVENTION OF THE DR. RUSSELL C. HAWES ENVELOPE MACHINE

For more than three quarters of a century, Worcester has occupied a prominent place in the development of the manufacture of machine-made envelopes. The third patent on a machine for making these essentials of every-day business life was issued to Dr. Russell C. Hawes, of Worcester, in 1854, and as the two preceding patents covered machines of no practical value, it may be asserted without fear of contradiction that the first successful machine in the United States for making envelopes was invented by a Worcester man and was made in that city.

While in New York, Dr. Hawes saw some hand-made envelopes, and returning to Worcester built his machine in the shop of Goddard, Rice & Company. He had been interested in perfecting the sewing machine and employed Hannibal Hamlin Houghton, of Worcester, who originated the rough surface feed, a device that made the invention practical, and for the completed machine was awarded a silver medal at a fair of the

Worcester County Mechanics Association, but as his employers, Goddard, Rice & Company, were threatened with court litigation by Elias Howe, they left the field, which a year later was appropriated by Singer who applied Houghton's rough-surface feed to his machine, defying Howe and ignoring Houghton's priority rights. Dr. Hawes turned over to Houghton his plans for an envelope machine, and the latter built the mechanism in Goddard, Rice & Company's shop, on Union Street, while another invention of Dr. Hawes, a machine for making paper bags, was also perfected by Houghton.

By the Hawes envelope machine the blank of the envelope was cut out by a die; then the sealing flap was gummed, the envelope blanks being spread out, one overlapping the other, and the gum being applied with an ordinary brush. When the gum had dried, the blanks were introduced into a self-feeding folding machine, and here Dr. Hawes first applied the principle which today is used on every successful and practical envelope machine in existence.

Up to the date of his invention, all attempts to make envelopes by machine had been directed only toward the folding of the commodity, the blanks being fed to the earlier machines by hand. The Hawes feeding device took 500 blanks, which had been cut and gummed on the flap, and applied gum to the upper side of the picker, which descended on top of the pile of blanks, causing the top blank to adhere to the pickers which lifted it to the carriage, where it was conveyed under a plunger and forced into a folding box. Small wings then folded over the flaps of the envelope and the gum by which the blank had been elevated to the carriage then performed a second office by sticking the envelope together. Requiring the services of one girl to attend the machine, and half the time of another girl to speed the gum on the sealing-flaps, three female operators could produce about 25,000 finished envelopes in ten hours.

Believing that his machine had attained its maximum capacity, Dr. Hawes sold his business in 1857 to Messrs. Charles W. and George F. Hartshorn and Joseph Trumbull, who were succeeded four years later by Trumbull, Waters & Company, when Lucius Waters bought an interest, and in 1866 by Hill, Devoe & Company. In 1889, W. H. Hill owned the envelope-making concern, and three years later he formed the W. H. Hill Envelope Company. By 1889 a girl operator attending two machines could produce 70,000 envelopes in ten hours, the principal improvements that had been made between 1853 and that date having increased the capacity, as well as the quality of manufacture.

Mr. Hill had acquired many patents that had been assigned to him by Abraham A. Rheutan, one of his employees, but as early as 1858, James G. Arnold, of Worcester, had devised a machine for cutting the material from a roll of paper, which also gummed and folded the envelope complete in one operation. He was the originator of the drying chain, by which invention the gum, which, on the first Hawes machines had been applied to the sealing-flap by a brush, was put on the envelope by the machine, and, following the folding of the envelope by the machine it was deposited in the drying chain, which was an endless belt, with fingers, and which kept each envelope separate while the gum was drying. While the Arnold machine was not a practical success, it embodied the fundamental principles upon which the self-gumming envelope device was predicated.

In 1864, G. Henry Whitcomb acquired the Arnold machine and under

the name of the Bay State Envelope Company began manufacturing envelopes, producing 100,000 per day two years later, his factory being the first building in the United States used exclusively for the manufacture of this commodity. In 1884 the Whitcomb Envelope Company was incorporated, all of the machines used being built on the premises, and the patents on them being purchased by the company from D. W. and H. D. Swift, of Worcester, who, in 1871, built an envelope-making machine upon an entirely new principle, which had a capacity of turning out 35,000 envelopes in ten hours. In 1876, they invented their first self-gumming machine. A girl operator could run two of these machines, and thus produce 70,000 envelopes each day, the product being automatically registered, the clock attachment being at that time the only machine registering device in operation in the world.

Following the invention of four distinct envelope machines, the Messrs. Swift patented an automatic printing press, for printing envelopes, the blanks being fed to the machines in lots of 3,000 or 4,000, picked up singly by an air-feed and carried into the press, where they received the impression of the type, and then were discharged on the opposite side and piled up ready for passage through the envelope folding machine. These printing machines were equipped with a stop-motion attachment, so delicately adjusted that a single hair stretched across the attachment would spring the let-off motion, and the press would automatically stop. Seven presses, each capable of producing 30,000 impressions in ten hours, could be operated by a man and a woman, making a total of 200,000, with but two operations. The efficiency of this machine will be appreciated when it is noted that from 11,000 to 12,000 impressions is a good day's work for an operative on an ordinary job printing press.

The value of the Swift machines was attested by the fact that several years prior to 1890, Herman Schott, the largest envelope maker in Germany; Alexander Pirie & Son, of Aberdeen, Scotland, then the largest producers of envelopes in the world; and Fenner & Appleton, of London, at that period one of the largest envelope manufacturers in England, equipped their factories with the inventions of the Worcester man.

In 1882, James Logan and George H. Lowe formed the Logan & Lowe Envelope Company, and on February 1, 1884, Mr. Logan, with Henry D. and D. Wheeler Swift, and John S. Brigham organized the Logan, Swift & Brigham Envelope Company and began the manufacture of envelopes. The concern grew fast and five years later erected a new factory, which was enlarged in 1897.

In 1864 George Henry Whitcomb began the manufacture of envelopes in Worcester, and was active in the business until August, 1898, when he sold to the U. S. Envelope Company for \$450,000 the assets and good will of G. H. Whitcomb & Company in which enterprise he had invested \$30,000. In the thirty-four years between the inception of the concern which bore his name and the day of the merger, he had amassed a personal fortune of more than a million dollars from the profits of the company.

THE UNITED STATES ENVELOPE COMPANY

On August 18, 1898, the United States Envelope Company was organized in which Mr. Logan was the leading factor. Made up of ten of the leading envelope manufacturing companies of the country, it was incor-



PLANTS OF THE UNITED STATES ENVELOPE COMPANY

porated with \$5,000,000 capital, which has since been increased to \$8,000,000.

Hon. James Logan was first chosen as vice president of the new corporation, and later as its president, which position he held until his death in 1928.

Neither competitive conditions nor recurring business recessions appear to seriously hamper the soundness of this New England owned and managed business enterprise. Although its myriad of plants and its selling activities are scattered from the Atlantic to the Pacific, the management is and always has been centered in Worcester and Springfield, while its stock is virtually all New England owned. But once in thirty years, since the inception of the consolidated business in 1898, has inventory deflation exceeded operating profits, and that was in 1921.

From 1900 to 1920, profits averaged between \$50 and \$60 per share, the 1919 figure being \$110 per common share, while \$115 was shown in 1920. All this was on the common stock of \$750,000, following the dividends of 7 per cent on \$4,000,000 of preferred. In 1921, as a result of a $33\frac{1}{3}$ per cent stock dividend and the subsequent issuance of \$750,000 additional common stock which was offered to shareholders at par, the total outstanding common was brought up to \$1,750,000. On this capitalization the 1920 profits were equal to around \$50 per share, while earnings for the preceding fifteen years averaged \$24. Since 1921 common stock earnings have averaged roughly \$20 per share annually.

Up to 1920 tremendous sums were plowed back into the property, with no common dividends paid during most of the period. During that period reinvestment of earnings in the plant amounted to \$6,285,000, or substantially in excess of the entire capitalization at the time—\$4,750,000, while common dividends for the period amounted to \$480,000.

Since 1920, including a stock dividend of \$250,000, the common has received \$1,465,000 in dividends—this exclusive of an extra of \$4 per share, while up to the end of 1928 an additional \$2,952,000 had been reinvested in plant. At the close of 1928, the plant was carried on the books at \$9,009,412.

The financial position of the company is steadily improving, due to the constant whittling down of the funded debt. At the close of 1928 there remained outstanding only \$950,000 first mortgage bonds of an original issue of \$2,500,000. For two years more retirements continue at the rate of \$100,000 annually, then they increase to \$150,000.

As of December 31, 1928, the current assets of the corporation totaled \$4,891,242, against current liabilities of but \$578,910.

Today, this Massachusetts enterprise is easily the dominant figure in the envelope business of America.

The Logan, Swift & Brigham Envelope Company, the Whitcomb Envelope Company, the W. H. Hill Envelope Company and the Logan Drinking Cup divisions of the United States Envelope Company are located, in Worcester, where also is situated a mammoth warehouse; the P. P. Kellogg & Company, and the Morgan Envelope Company divisions, are in Springfield; the National Envelope Company division is in Waukegan, Ill.; the two divisions of the Plimpton Manufacturing Company are in Hartford, Conn.; the Monarch Envelope Company division is in Philadelphia; the White, Corbin & Company division is in Rockville, Conn.;

the Pacific Coast Envelope Company is in San Francisco, and the Central States Envelope Company is in Indianapolis.

In addition to standard lines of commercial envelopes, the corporation manufactures the Columbian clasp, and outlook envelopes, papeteries, toilet papers and drinking cups.

It employs upwards of 3,000 operatives. Hon. James Logan was president up to the time of his death in November, 1928; Willard E. Swift is president; Eldon V. Johnson, first vice president and general manager; Ernest M. Whitcomb, second vice president; Robert L. Allison, third vice president and assistant general manager; W. M. Warfield, secretary, and W. O. Day, treasurer.

THE L. W. POND MACHINE & FOUNDRY COMPANY

Samuel Flagg was the pioneer manufacturer of machinists' tools, in Worcester, removing there from West Bolyston. At the time of his advent it was asserted that Flagg could supply, with his small force of six or eight men, all the machine tools that were then required in the United States. The Flagg planer was one of the major inventions of the concern. He retired from the firm of Samuel Flagg & Company in October, 1853, when he sold his interests to his remaining partners, of whom Lucius W. Pond was one.



LUCIUS W. POND
of Worcester
Pioneer machine tool
builder and progenitor of
the present-day L. W. Pond
Machine & Foundry Com-
pany of Worcester

In 1854 Mr. Pond became the sole owner of the business, and he erected a new shop on the site of the original plant, but it had scarcely been completed before it was destroyed in the great fire of June 14, 1854, which burnt about seven acres of buildings.

Few dared to predict when Mr. Pond became the pioneer of those establishments, which, from their number, have given such a distinctive character to the city of Worcester, that within twenty years thereafter 1,000 mechanics would be employed there in the making of machine tools. Someone said of L. W. Pond that if he were to be asked to define his position, he would promptly reply that it was bounded on the north by engine lathes, on the east by planers, on the south by steam engines and bolt cutters, and on the west by machinery for all sorts of purposes. In 1891, the concern acquired the business established in 1865, by Caleb Colvin.

Today, the L. W. Pond Machine & Foundry Company employs 250

men, and has capital of \$80,000. Mrs. Mary H. Ahern is president, M. A. McCarthy, secretary, and P. T. McDonough, treasurer. Grey iron castings for machine tools are the specialties of the concern.

THE HUDSON BELTING COMPANY

The Hudson Belting Company dates from 1854, when Peter Goulding began the local manufacture of leather belting. He was succeeded by H. O. Hudson & Company and rubber belting and loom straps were added to the company's products.

The corporation now has capital of \$200,000, and employs thirty-five operatives. John W. Grant is president and general manager, and R. N. Blakeslee, Jr., is treasurer and secretary.

THE CALLIOPE INVENTED IN WORCESTER

About the middle of the nineteenth century, the manufacture of organs was commenced in Worcester, N. B. Jewett, Milton W. Morse, John A. Farley, John G. Pierson, E. Harrington & Company, A. Davis & Company, the Loring & Blake Organ Company, the Taber Organ Company, the Worcester Organ Company, Redding & Harrington, A. H. Hammond, George W. Ingalls & Company, the Munroe Organ Reed Company and other individuals and concerns being represented in the list of producers at periods up to the beginning of the present century.

It was in 1886 that a Worcester man, J. C. Stoddard, invented the steam calliope and that year the Steam Music Company was formed to manufacture this universal musical instrument. Three years later twelve hands were engaged in the production of calliopes and "terpsichoreans"—the latter being described as "an entirely new thing, whose notes are agreeable and pleasant to the ear." At that time the concern operated under the name of the American Steam Music Company.

THE CONTRIBUTION OF HORACE H. BIGELOW TO SHOE PRODUCTION

Horace H. Bigelow was the inventor of many shoe machines used in the early days of factory production, the first of major importance to cut heels and prepare them for nails being produced in 1847.

In 1869 he patented a shoe heel, and the following year he introduced the Bigelow heeling machine, an improvement on the McKay device, with which its interests were identified. By means of the Bigelow product all the odd shaped pieces of sole leather, formerly considered valueless, were utilized, by being joined or fitted together, under a solid upper lift, and fed to the machine, which consisted of a revolving cylinder. The first operation pressed the heel; the second quarter revolution pricked the heel for the nails; the third quarter revolution drove the nails, and the final ejected the finished heel from the cylinder.

The machine not only utilized pieces of leather of every kind and shape, but worked all heels, whether whole, half or quarter lifts, and saved one lift on each boot and shoe heel, since the leather which would otherwise be trimmed off was by reason of the equal pressure upon the heel from all sides, evenly and smoothly forced into the heel, thus elevating it, and making a difference of one entire lift in height. At that period a good lift was worth about two cents, and not only was this amount saved, but the machine accomplished the most laborious part of the work in fabricating a boot or shoe. With the machine, a man and a boy could heel

5,000 pairs a day, effecting a saving of the wages of forty-eight additional operatives per day.

Mr. Bigelow brought this device to a high state of development and made it one of the most important cost-reducing factors for which his genius was responsible. His heel-compressing and heel-attaching machines were the means of bringing to him a comfortable fortune.

In 1850 he and his uncle, Charles D. Bigelow, engaged in shoe manufacture in New York City, but a few years later he returned to Massachusetts and devoted his time to the production of a pegging machine, later becoming a partner in the Bay State Shoe Company of Worcester. At the Vienna Exposition, in 1873, Mr. Bigelow made a very impressive exhibit of boot and shoe machinery of his invention, including the gang-punch, which made several holes in leather at the same operation; a pegging machine which employed a knife, instead of a saw, channeling and heel-trimming machines, and his machines which fashioned heels out of scrap leather, the Bigelow Heeling Machine Association having been formed in 1870, and the products having by the year of the exposition found their way into Great Britain, France, Belgium, Switzerland, Austria and Spain, as well as throughout this country. In 1875 the Bigelow concern was consolidated with the McKay Heeling Machine Association under the name of the McKay & Bigelow Heeling Machine Association.

THE THOMAS SMITH COMPANY

The Thomas Smith Company manufacturers of bolts, nuts, washers and metal stampings has a history running back to 1854 when the late Thomas Smith and William Conkey began business. They purchased of J. and J. C. Brown and George Dryden their tools and interests in the manufacture of nuts and washers and chain links, and in 1859 they were employing four hands in the production of patented bit pieces and cold punching. Later bolts, rods, building irons for houses and bridges, were added.

Mr. Smith made the first die in the world to manufacture a mowing-machine knife, and he also worked on the first looms built for William Crompton, while in the employ of Messrs. Phelps and Bickford.

For seventy-six years the concern has been producing light and heavy steel stampings of endless number and variety. The ever-progressive spirit of its management has continually kept abreast of the times and no better equipped steel stamping plant is to be found in the Bay State. Recently the latest and best machinery for automatic shape cutting of all steel parts has been installed to take care of the wider scope of such work which has developed in the past few years. This department, among the first to be equipped with oxygen for cutting, expanded to such an extent that the management sought newer methods of cutting and becoming convinced that automatic cutting was efficient and economical, installed the latest devices in this field. The firm carries at all times bolts and nuts and washers of all standard dimensions and turns out gear blanks, steel bead fittings for jack spools and bobbins, and specializes at its Grove Street plant in automatic shape cutting of all steel parts, for the automobile and special machinery industries.

The corporation has capital of \$45,000, employs thirty or more operatives and is managed by William M. Mill. Mrs. Ella M. Foye is president and treasurer, and Mrs. Mildred E. Mill, is secretary, of the concern.

JOHN JACQUES & SON

In 1855, William Kean formed the firm now known as John Jacques & Son, Kean being succeeded in turn by John Toulmin and George Rowe. The Jacques organization has greatly enlarged the type of production. Herbert E. Jacques is the sole proprietor, and the company features the manufacture of shears.

THE BAKER BOX COMPANY

For exactly seventy-five years the Baker Box Company has continuously operated in the field of manufacture of wooden packing boxes, box shooks, sawdust and shavings. The concern was established in 1855 by the late Charles Baker, and in 1862 it was largely engaged in producing lumber, which it marketed at wholesale. Four years later the manufacturing department was inaugurated. The corporation has capital of \$48,000, employs seventy-five operatives and is managed by Charles Baker, president, and P. N. Curtis, treasurer and secretary.

THE ARCADE MALLEABLE IRON COMPANY

The Arcade Malleable Iron Company established in the fifties by Warren McFarland, absorbed the Worcester Malleable Iron Works, in 1886, and was first incorporated in 1906 removing to its present location the following year. It was incorporated in 1923.

It is the only manufacturer in the East of malleable detachable chains, sprocket wheels and buckets, and for nearly three quarters of a century its guaranteed malleable iron castings, carefully and skilfully moulded in its thoroughly modern foundries, have commanded a market which has grown to such an extent that upwards of 300 operatives are constantly employed, stamping it as one of the larger metal-trade industries of the city.

The corporation has capital of \$500,000. H. P. Blumenauer is president, and R. J. Nelson, treasurer, and a strong board of directors, including such industrial and financial leaders as President Blumenauer, F. A. Drury, J. V. Critchley, Bowen Tufts, Arnold Whittaker, John F. Tinsley, George Perry, and Edward L. Bennett adds to its influence in the manufacturing life of Worcester.

In 1856, Richard Ball and Charles H. Ballard, operating under the firm name of Ball & Ballard, began the local manufacture of Daniels' improved planing machines, Gray & Woods' patented planing machines, improved tenoning and sash stitching machines, scroll saws and matching machines.

THE SAMUEL WINSLOW SKATE MANUFACTURING COMPANY

When Seth C. and Samuel Winslow ventured to manufacture twenty-five pairs of skates, in 1857, of which total they sold nineteen pairs that year, they little dreamed that thirty years later the concern they founded would have a capacity of producing 1,200 pairs each working day, or 360,000 a year, and that a ready market would be found for that number. In 1858, anticipating a "heavy demand" they produced 200 pairs, but before they tore off the calendar for December they had produced and sold 2,500 pairs. Upon the death of Seth C. Winslow, in 1871, the business passed to Samuel Winslow, and, as early as the following year, Win-

slow skates were being exported to Europe and India. In 1880, he invented the famous Vineyard roller skate, which proved to be the most popular type ever made, and for five years production could scarcely equal the demand and large factory additions were required. By 1889 the domestic sales of this type practically ceased, but the company developed markets in Australia, India, Japan, and South America and that year forty different styles of ice skates and fifteen of roller skates were being made by the Samuel Winslow Skate Manufacturing Company.

For a quarter of a century the concern has ranked as the largest manufactory of skates in the United States, and it employs 200 operatives constantly. A comparison of its present day products with those of the last century shows as marked a divergence in design and appearance as one observes between the first "one-lunger" automobile of the early nineties, and the latest 1930 model.

The company is housed in a large brick plant on Millbury Street, and has capital of \$150,000.

Hon. Samuel E. Winslow, son of Samuel Winslow, one of the founders, is president and treasurer, and his son, Russell Winslow, is vice president. G. H. Waite is assistant treasurer.

President Winslow represented Massachusetts in the national House of Representatives for many years, and at present is the efficient and able chairman of the United States Board of Mediation, to which position he brought a wealth of practical business and governmental experience, which has stamped him as one of the country's ablest public servants.

THE GOLBERT LAST COMPANY

The Golbert Last Company is the successor to Samuel Mawhinney and A. P. Richardson, who began the manufacture of shoe lasts, in 1857, Robert L. Golbert becoming identified with the concern, in 1889. It was incorporated in 1905.

Worcester offered a fertile field for such a venture, inasmuch as the county early became the seat of many large shoe manufacturing enterprises, and thus provided the concern with a large local market for its products, which has been extended during the intervening years.

L. A. Wheeler is president and treasurer and A. J. Williamson is secretary of the corporation, which has capital of \$40,000, and employs forty operatives.

THE J. R. TORREY RAZOR COMPANY

In 1858, Joseph R. Torrey began the manufacture of razor strops and dressing cases, with eight employees, and in 1880, Joseph Turner became a member of the firm. His son, Lewis H. Torrey was admitted to the partnership in 1885, and in 1905 the original factory, erected in 1882, was doubled in size. The company was the first in America to successfully manufacture razors, and during the past seventy-two years, many improvements in processes, special machinery, and handles, have been introduced by it. The J. R. Torrey Razor Company has capital of \$104,000. William Turner is president, J. J. Turner, vice president and manager, and Joseph R. Torrey, II, is treasurer.

Forty hands are employed and as auxiliary to the manufacture of razors, J. R. Torrey & Co., a concern owned by Lewis H. Torrey, em-

employs twenty-five operatives in the production of razor strops and leather specialties.

THE HAMMOND REED COMPANY

In 1859, Andrew Hill Hammond received a patent on the manufacture of organ reeds, with the tongue cut from the same piece of metal as the plate, and without a rivet. Devising a machine to manufacture the reeds, the firm of A. Davis & Co., bought his patent, and later admitted him as a partner, with Augustus Rice and Edwin Harrington.

In 1865, Mr. Hammond became the sole owner of the business and erected a factory containing 9,000 square feet of floor space the following year on the site of the present plant. In 1869 he invented and patented a reed with a new method of fastening the tongue to the reed-block, and as his business grew material additions were made to the plant, while numerous inventions of machines were made by him, which superseded hand operations.

For more than seventy years the ownership and control of the Hammond Reed Company has remained in the founder and in his son, Richard H. Hammond who is president and treasurer of the corporation, which has capital of \$100,000.

The products of the present day are organ reeds and boards. The modern plant, with numerous additions that have been made from time to time, is the largest of its kind in this country, devoted exclusively to the production of reeds and boards.

JOHNSON & BASSETT, INC.

In 1860, E. C. Cleveland began the manufacture of woolen machinery, and three years later he built the first set of the Cleveland cards, which became so famous in after years, and which were used for converting wool into roving previous to its being spun.



E. C. CLEVELAND
of Worcester
A pioneer inventor and
manufacturer of woolen
mill machinery

Before his death, in 1871, Mr. Cleveland became the largest manufacturer of woolen machinery in New England, with one exception, and during the sixties he occupied a three story factory, 400 by 50 feet, with forge, paint and dyehouses attached. Associated with him as a partner, during a portion of the decade of 1860-70, was John C. Mason, the con-

cern being known as Cleveland & Mason, and it employed between 150 and 200 mechanics at that period.

Mr. Cleveland patented several important woolen finishing machines, and the company installed its carding and other equipment in the leading woolen plants of Massachusetts and Rhode Island.

Following Mr. Cleveland's death, S. W. Goddard continued the business, and introduced many new machines, the products including about fifty devices for woolen mills, as well as all kinds of cards for wool, worsted, felt, and shoddy products, and twisting, roving, spooling, picking, drying and cloth finishing machinery. James H. Whittle succeeded Mr. Goddard, and in 1910 the Johnson & Bassett Company bought all the patterns of the full line of machinery.

In 1868-69 experiments were carried on by Edward Wright, in the Cleveland and Bassett shop looking toward the development of self-operating jacks, and on the failure of the latter firm in 1869, he arranged to carry on his work in the plant owned by Johnson & Bassett, which partnership was formed on July 1, 1870. That year the initial installation of the self-operating attachment for jacks was made in the mill of John Chase & Sons, in Webster, and Johnson & Bassett, Inc., began the manufacture of automatic spinning machinery.

In 1886 the four-story and basement factory, on Foster and Bridge streets, now occupied by the concern, was erected.

Thus for fifty years under the name of Johnson & Bassett, and for ten years before, the two units have provided mules of the highest standard obtainable, which have been shipped to all parts of the world.

The factory is equipped with the latest types of machinery for efficient and quality production, and in addition to being spinning machinery specialists the concern also manufactures a line of Dover pantographs, which is giving great satisfaction in the print mills of the country. Bobbin winders, special dressed mule banding, the finest quality of spindle banding, spools, bobbins, paper tubes of special design for use with heavy spindles, and bobbin holders are also produced by the company.

The corporation has capital of \$225,000 and employs upwards of 100 operatives. George M. Bassett was president and treasurer, up to the time of his death, in 1929, Charles E. Williams, vice president and general manager, and C. D. Kelly, assistant treasurer and secretary.

AMERICA'S GREATEST VALENTINE CONCERN

For seventy years, Worcester has annually turned out more valentines than any city or town in the United States and probably in the world. This production grew from a home industry, which was established in a modest farm-house on the barren and black hills, of East Rutland, by the late George C. Whitney, and his brother, Sumner, who formed the George C. Whitney Company and who worked together, producing valentines by hand, later transferring the modest business to 86 Elm Street, Worcester. In 1866, Sumner Whitney retired, his place being taken by another brother, Edward C. who left the firm about 1870. The founder, George C. Whitney continued the business, and about 1895 began acquiring competing firms until he had absorbed ten or more. Prior to his death, in 1915, he saw the company which bears his name grow from the two original employees to 450, and the horizon of commodities expand to include cards, booklets, for the Halloween, Christmas, New Year, and

Easter seasons, and calendars and calendar-pads. His son, Warren A. Whitney became president and treasurer upon the death of the founder, and today the concern employs upwards of 500 workers at its Union Street factory.

The corporation has capital of \$1,300,000. John T. Mercer is vice president, and Edgar Whidden, secretary.

THE ROYAL WORCESTER CORSET COMPANY

In 1861 the late David Hale Fanning founded the Worcester Skirt Company, and with one operative began the manufacture of hoop skirts. In 1864 he added corsets to the line of products, becoming thereby the pioneer American manufacturer of these garments which, up to that time, had been imported into this country. On March 1, 1872, the name of the concern was changed to Worcester Corset Company. Four years later the late Hon. Theodore C. Bates became a partner, and later he was chosen as president of the Corset Manufacturers Association of the United States, which office he held until he retired from the business.

In 1901, the enterprise took the name of the Royal Worcester Corset Company, by which it is known today.

The founder lived to see the concern grow from one employee to 1,800 operatives, before machinery completely supplanted the hand operations, and the small room where he began business develop into 168,218 square feet of manufacturing space.

For a concern that was supposed to represent a somewhat defunct industry, the company's showing during 1927 was noteworthy. Since 1922, the corporation, the largest of its kind in the world, had been exhibiting sizeable losses with regularity. Prior to that year it had been highly successful and had paid dividends as high as 50%, and a 200% stock dividend. In 1927, however, it earned better than \$4 per share on the 24,000 no par shares outstanding. The "come-back" was attributable to new management, and to the introduction of a policy of inventory control and merchandising. It was found that corsets had not disappeared from use—but that styles had changed. Old styles were therefore rapidly liquidated and today Royal Worcester products are fashioned to meet each season's mode.

At the close of 1927, inventories stood at \$356,255, the smallest figure in years, comparing with \$512,894 in 1926 and \$1,093,309 in 1924. Inventories were turned more than six times during 1927. Today the company's foreign business is rapidly expanding.

As of December 31, 1927 current assets amounted to \$1,083,696 with current liabilities of only \$33,956, leaving "net quick" assets of \$1,049,740, or \$43 per share of stock. Cash alone amounted to \$8.91 per dollar of the company's current bills.

Arthur H. Gray is president, Harlan T. Pierpont, clerk, and Albert W. Avery, is treasurer of the corporation, which has capital of \$2,400,000, and employs upwards of 500 operatives.

THE WORCESTER BLEACH & DYE WORKS COMPANY

The Springside Dye Works were established in 1861, by Messrs. Taft and Wheeler, being taken over by Hackett & Healey, three years later, and in 1870, by George F. Orr and Neil Walker, the latter retiring three years afterward, when Peter Wood purchased his interest. At that time

the name was changed to Worcester Bleach & Dye Works, which title has been maintained for almost sixty years, although the concern was not incorporated until 1892. The original plant was located at the corner of Gardner and Southgate streets, but later the business was moved to Grove Street, opposite Salisbury Pond, where it was carried on until 1888, when it was transferred to its present location, on Fremont Street. For thirty years, the late James E. Orr was its active manager.

At the present, the corporation occupies over 150,000 square feet of manufacturing space, and its operations include the bleaching, dyeing and mercerizing of cotton yarns and warps, winding on cops, tubes or cones, the manufacture of cotton yarns in fast colors, glazed yarns, artificial silk, and the production of sewing and stitching threads.

Today it employs upwards of 200 hands, and is managed by John H. Orr, president and secretary and George M. Orr, treasurer.

WORCESTER MANUFACTURERS HELPED TO SAVE THE UNION CAUSE

Worcester's industrial contributions to the success of the Union cause during the Civil War were important and significant.

B. F. Joslyn had been granted a patent on January 30, 1856, covering a new rifle, which was claimed to be superior to the Sharpe-type, then in vogue, on account of its rapidity, simplicity, safety and cost of construction. Three years later the firm of Joslyn & Freeman began the manufacture of the invention, and in 1860, the War Department ordered a thousand of the rifles—the largest single order for fire-arms ever given to one producer in the country up to that time. The Navy Department had previously bought five hundred of Joslyn's products, and the local factory operated day and night.

All the local iron-working establishments were providing the Government with ordnance. Nathan Washburn was producing five tons of rifle-barrel iron a day for the Springfield Armory, and was under contract to provide 100,000 musket barrels. Osgood Bradley was building gun-carriages and forges, while Wood & Light were engaged in providing machinery for the Springfield armory. Shepard, Lathe & Co., were under contract to provide for the Colt and Burnside factories and for the Federal armory, at Springfield, all the machinery they could turn out, and Allen & Wheelock employed 200 operatives on government work. L. W. Pond built twenty-eight rifle-cannon in the Goddard, Rice & Co., shop, each weighing 450 pounds, and costing \$350 apiece. The eighteen-inch ball fired by these guns could be thrown three miles.

Ball & Williams were employing a hundred men in the manufacture of the Ballard Cavalry breech-loading rifle, the invention of Mr. Ballard, one of the foremen in the Ball & Williams shop.

W. X. Stevens, a local inventor, patented the Stevens platoon-gun December 29, 1862, and the following April, Charles S. Coleman, of Worcester, invented a breech-loading gun. Ethan Allen & Co., were producing from 20,000 to 50,000 cartridges a day before the close of the war.

THE WHEELOCK STEAM ENGINE

The Wheelock engine as invented, developed and built by Jerome Wheelock, from its inception in the early sixties and until 1888, embodied many unique features which attained for it a unique place in the steam engine field.

It was in 1864 that Mr. Wheelock invented and began to manufacture the sectional ring and piston packing, which afterward was extensively used in every type and make of engine. Five years later he built the first engine embodying these improvements, and, in 1873, he exhibited, at New York, his four-valve engine, which employed the rotary tapered valve, suspended on hardened steel spindles—a type which became widely used.

He also invented and patented feed-water heaters and condensers, and in 1873 and 1874 was turning out a large number of engines, the greater proportion of which were of 500 horse power.

But more than a score of years elapsed from the time he began to develop improvements in the steam engine before he received his patents on the most important of his inventions—the so-called new system valves, undoubtedly at that time the most original and effective departure in engine construction since the contributions made by George H. Corliss.

The exception, if any, was the invention of Nathaniel H. Greene, of Providence, R. I., which was embodied in the Greene engine, a type that became popular in some localities.

Of course it is true that all automatic cutoff valve gears employ the detachable principle, as at least introduced and controlled by Corliss, and while the Wheelock system necessarily involved the use of that idea, in practically every other respect it was as original and as unlike the Corliss, or any other system as a valve gear can well be, and this originality was universally acknowledged by engineers. It was early recognized that the Wheelock system was potentially the most serious rival that the Corliss system had encountered. A fair idea of the Wheelock product cannot be drawn from the extent of the use of his engines in the United States, as there were unfortunate limitations not dependent upon the valve of the engine.

In appraising its worth consideration should be given to the extensive adoption of the Wheelock invention by builders in other countries where it attained greater popularity and proportionately wider application than it did in the United States.

Mr. Wheelock went abroad in 1886 and 1887, secured patents in all the leading countries, and licensed concerns of the first magnitude and of high standing in the manufacturing world in England and France, and later in Canada, to build his engines. Thousands were manufactured, and in Canada the Wheelock engine became the most prominent type, while in Europe it achieved an equality with the Corliss product. Numerous modifications were adopted in several other countries notably Germany, where a number of hyphenated Wheelock system engines were evolved by builders.

Geographically, the use of the Wheelock product was as widespread as that of the Corliss engine, and had the production in the United States been favored with the administrative ability of another George H. Corliss the Worcester engine would have been as generally used as the Providence type. It was in 1885 that Mr. Wheelock received his United States patents on the most important of his inventions—the so-called new system valves—which had for its fundamental idea the combining of the valve, the valve-seat, and the operating parts within a shell, or tapered plug, which was driven into a corresponding hole in the cylinder, and retained in place without bonnets or bolts. By employing this entirely new

and novel method of driving the valve, economical results in the use of steam were obtained.

In 1887 Mr. Wheelock sold the American rights to the Wheelock Engine Company, and in 1896 the American Wheelock Engine Company took on the business, carrying it on until 1902, when it was merged, with other interests, into the American & British Manufacturing Company. From 1896 to 1899, the Wheelock engine was built for the American Wheelock Engine Company in Philadelphia, Chicago and Milwaukee, as well as in Worcester, and in the latter year the Providence, R. I., plant of the Corliss Steam Engine Company was acquired, and the Worcester unit was removed to that city.

Edward K. Hill who became president and manager of the Wheelock Engine Company in 1888, and who was a graduate of Worcester Polytechnic Institute, materially contributed to the efficiency of the valve gear through his inventions, coupled with those of Nathaniel T. Greene, and, subsequent to 1895, these joint improvements were installed in all Greene-Wheelock engines, and assisted in the product attaining an equal rank with the Corliss type.

C. STEWART & SON

In 1864 Messrs. Stewart & Dillon established the Stewart Boiler Works, Charles Stewart, the senior partner succeeding to the business five years later, and purchasing the boiler business of Rice, Barton & Fales, prior to 1872. From the latter year to 1875, Mr. Stewart was in partnership with William Allen, and today John C., Charles M. and Howard R. Stewart conduct the partnership of C. Stewart & Son, employing about 100 men, in the manufacture of several types of boilers. Electric cranes and pneumatic tools have supplanted the former plant equipment.

THE COLVIN AND EARLE ENTERPRISES OF 1865

Caleb Colvin established the Caleb Colvin Foundry, in 1865, enlarging the original plant many times. In 1887 the business was incorporated under the name of the L. W. Pond Machine & Foundry Company and iron planers, pulley-turning and boring machines were added to the casting of metals.

In the sixties, the machine card-clothing plant of T. K. Earle & Co., was equipped with upwards of one hundred card-clothing machines, which embraced many important improvements that had been contributed by Pliny Earle, and at that time upwards of five hundred square feet of cards were turned out daily.

In 1865, the firm, in association with other Worcester capitalists, established an extensive plant for the manufacture of stoves under a patent granted to Sidney Smith, superintendent of the Earle factory.

THE NOTABLE INVENTIONS OF A. W. GIFFORD

Prior to 1866 the machine used in the screw business was known to the trade as the turret-head, used by gunsmiths, sewing-machine manufacturers, and at the government armories at Springfield and Harper's Ferry—a device ill-adapted to the class of work required of it. A. W. Gifford, of Worcester, invented a machine which entirely superseded the old type, and which completely dominated the field for many years. The old turret-

head machine consisted of a revolving traverse spindle, with a dial for holding a series of tools. In 1866 Mr. Gifford and E. A. Bagley were the pioneer producers of machine screws, and twelve years later the former became the sole owner of the concern, and erected a new plant on Beacon Street, 250 by 36 feet in dimensions.

In 1866 Mr. Gifford received a testimonial from the Worcester Mechanics Association for a case of milled machine screws, which probably were the first made in the city, county, or Commonwealth. On September 28, 1875, he was granted a patent, followed by another on December 26, 1876, on a machine which cut the blanks automatically to the length required for the screw, and which fed them into the machine where they were simultaneously milled, threaded, and pointed. He employed 100 hands in 1889, used some 400 tons of iron and steel each year, and sent his products to all parts of the United States.

He invented and built all the machinery put into a factory he erected in 1889, and the following year sold the business to the Standard Screw Company which ultimately became a \$4,500,000 corporation, and of which Mr. Gifford was one of the vice presidents. The Worcester Machine Screw Company, one of the divisions of the amalgamated corporation, continued to operate its local plant, which, in 1913, was greatly enlarged.

S. PORTER & COMPANY, INC.

The present corporation, known as S. Porter & Co., Inc., was established in 1866 by Alonza Colby and Samuel Porter, as Colby & Porter. Seven years later Mr. Porter withdrew and E. H. Swan entered the firm, which became Colby & Swan. In 1885, Mr. Porter bought the business and conducted it in his name for ten years when Thomas W. Gardiner became a member of the firm, which was known as Porter & Gardiner. In 1896, Mr. Porter bought the Gardiner interests, and carried on as S. Porter & Co., which name was retained until the business was incorporated in 1913, as S. Porter & Co., Inc.

Between 1896 and 1913, Walter C. Porter, O. A. Benoit, and Walter C. Porter were partners, the latter continuing as sole owner from 1912 to 1913, following the death of Walter C. Porter, who lost his life in the *Titanic* disaster. Upon the incorporation of the concern, Mr. Bigelow became president, treasurer and general manager, Anne L. Clarkson, clerk and assistant treasurer, Arthur B. Holmes, superintendent, and Herbert L. Worcester, chief model maker. In 1920, O. Stanley Porter, son of Walter C. Porter was admitted to the corporation, and placed in charge of sales, the original organization with this one change in personnel having been adhered to for seventeen years.

For nearly forty years the company has made a specialty of lasts for women's shoes, its output being sold throughout the United States and Canada, and in some foreign countries.

W. E. Bigelow is president and treasurer, and A. L. Clarkson, is secretary, of the corporation, which has capital of \$75,000, and 100 operatives are employed, in its Union Street plant.

THE UNION WATER METER COMPANY

In 1865 Phineas Ball, a local civil engineer, and the following year, Benaiah Fitts, a skilled mechanic, began attempts to solve the problem of inventing a water meter. In July, 1869, they joined in securing a pat-

ent on a double-acting single-rotary valve-piston meter, the Union Water Meter Company having been organized the previous November to manufacture the device when it became apparent that they had created a practical device.

John C. Otis joined them in forming the original partnership, and was active in the management of the concern until his death.

Soon after the company was established the patent rights for Great Britain and Ireland were sold, and a company was formed in London to manufacture and market the meters invented by Messrs. Ball and Fitts.

That the two Worcester inventors hit upon the correct fundamental principles in evolving their meter is apparent from the fact that in the intervening sixty years since the initial device was offered to the public the concern has continued to develop and progress.

Advances in design and construction in many important features have been originated by the Worcester company, and today its products are in use the length and breadth of the land, and in England and Germany.

The company began receiving medals of award for the excellence of its products over half a century ago. At that time expositions were promoted by various associations, and among the earliest were those sponsored by the Worcester County Mechanics Association which gave to the Union Water Meter Company a number of first awards.

The greatest exposition in the industrial history of the world up to 1876 was the famous Centennial, at Philadelphia, and here, the Worcester company received medals of highest honor.

While competition in the meter field increases, with new concerns springing up over night and old enterprises struggling to hold their business the Union Water Meter Company has gone forward with constantly accelerated speed.

Its products include cold and hot water, oil and gasoline meters, Union Fitts chronometer valves, Union press for lining service pipe with cement, Union pressure regulators, without springs, and Worcester steam fire signals.

The corporation has capital of \$75,000, and employs seventy-five operatives. H. A. B. Etheredge is president, E. S. Otis, treasurer, and they with E. F., H. B., and D. K. Otis, descendants of one of the founders, and C. G. Stratton, constitute the board of directors.

THE WELLS CHEMICAL BRONZE WORKS

The Wells Chemical Bronze Works, incorporated in 1906, had their beginnings, in 1867, when L. H. Wells and Herbert M. Rice began business, the former inventing his bronze metal, largely and successfully used for bearings, in 1877. By the use of chemicals the oxidation of the tin, one of the ingredients, was prevented by Mr. Wells' process, while the metal possessed ten per cent greater density, than ordinary bronze, and was of a firm, tough structure. In 1887, Mr. Wells purchased the Chapin Foundry, on Summer Street, to which he removed his business. Here he operated the largest set of furnaces in Worcester, and his castings were cleaned by power in a large water rumble,—a hollow cylinder, which made ninety revolutions a minute.—and he employed emery wheels for smoothing the castings.

The process of casting consisted of melting the metal in crucibles made

of plumbago, and then turning the molten metal into moulds, the product being cleaned and finished when taken out.

Martin J. Comeau is president, and M. E. Hamilton is treasurer and secretary of the corporation, which is capitalized for \$99,000 and which employs twenty-five operatives in its Temple Street plant.

THE HOWARD BROS. MANUFACTURING COMPANY

Since 1866 Worcester has been famous for the production of machine card clothing for it was in that year that the present Howard Bros. Manufacturing Company was founded by C. A., A. H., and John P. Howard, and the enterprise operated as a partnership until 1888, when it was incorporated.

In 1892 the concern erected its present factory, in which machinery of its own construction and much of it of special design, was installed, and it now occupies upwards of 70,000 square feet of manufacturing space.

The research department of the corporation has developed Tuffer card clothing to a point where the product has become one of its leading commodities. Continued tests of card wire and foundations, with emphasis on the toughness, strength, temper, carbon properties, grinding operations, smoothness, and uniformity of the wire, and the building of specially constructed foundations, made in the company's plant, from carefully selected cloths produced in American mills, and the use of oil-proof glue, thereby contributing to the flexibility of the foundations, have enabled the concern to control the American market for Tuffer card clothing, it being the only manufacturer of this commodity.

Heddles for weaving and hand stripping cards are also produced, and the company operates branches in Atlanta and Philadelphia.

Herbert Midgeley is president and general manager, and Harry C. Coley, is treasurer and secretary of the corporation, which has capital of \$300,000 and employs upwards of 125 operatives.

THE BURLINGAME MACHINE COMPANY

The Burlingame Machine Company formerly the A. Burlingame Company, has a background of more than sixty years, being the successor of the Washburn Steam Works, incorporated in 1867, by George I. Washburn, the inventor of an upright high speed, valveless steam engine, with twin cylinders, each having several pistons on one piston-rod, a device which did not prove practical. Mr. Washburn next turned his attention in another direction, and invented the Washburn steam pump, the production of which was begun in 1868, and which proved eminently successful. In 1872, A. Burlingame purchased the business, and eight years later changed the name to A. Burlingame & Co., and built plain slide-valve engines up to fifty horse-power. This was followed by the invention of an improved balanced slide-valve engine, and later by a Corliss type product, each of which was built up to one hundred horse-power. Today the concern specializes in machine work, piping and engineering.

C. E. Tideman is president, A. V. Sponberg, secretary, and E. C. Hopkins treasurer, of the corporation, which employs twenty-five operatives, in its Commercial Street plant, and which has capital of \$50,000.

In 1867 J. S. Wheeler & Co., began the manufacture of the Wheeler planer, in Worcester.



HOWARD BROTHERS MANUFACTURING COMPANY,
WORCESTER



OLD PLANT OF HOWARD BROTHERS MANUFACTURING
COMPANY, WORCESTER



PRESENT PLANT OF HOWARD BROTHERS MANUFACTURING
COMPANY, WORCESTER

B. S. ROY & SON COMPANY

B. S. Roy began the manufacture of card-grinders, for grinding card-clothing, in 1868, all the machines being of his own invention. The former method of grinding cards provided for the spreading of emery on a board, which was rubbed back and forth over the end of the wires, thus sharpening the teeth. This was followed by the construction of a machine, with a cylinder covered with emery, but with no traverse wheel, and consequently the teeth were ground unevenly. Mr. Roy provided for a traverse wheel, carrying an endless chain back and forth on the cylinder over the teeth of the card with a rotary motion. B. S. Roy & Son Company has built up a business which enables it to supply not only the needs of this country but of South America, Mexico, Canada, England and Ireland.

No small part has been played in the building of the reputation which the city of Worcester has attained as a producer of high-grade textile machinery by the development in the art of grinding, and the products of the Roy concern have come to be regarded as standard equipment, in the leading mills, both north and south.

When B. S. Roy invented his first machine—the traverse grinder—in 1868, he became the pioneer in the production of highly specialized equipment and completely revolutionized the process of keeping woolen and worsted cards in proper working condition. At that time, he was employed as an overseer of carding, in Rochville, Conn.

In 1915 the firm of B. S. Roy was incorporated as B. S. Roy & Son. The present assistant treasurer and general manager, William A. Underwood has from time to time made major improvements on machinery, inventing the N. & Z. portable calender roll grinder designed to grind paper mill calenders without dismantling the machines, and which is one of the leading products of the concern today. Sylvanus B. Roy, a son of the founder of the company was an inventive genius, devising a number of improvements on woolen machinery, including the traverse grinder for carding engines, which bears his name and which revolutionized the method of grinding this type of engine, and altogether he was given upwards of thirty patents on card-grinding machines, as well as others on looms and steam engines. He became popularly known as the father of card-grinding machinery throughout the United States, as well as abroad.

The present-day products of the Roy concern include grinders for woolen, worsted and cotton cards, shear blades, napper, garnett and calender rolls. Calender rolls used in both the textile and paper-making industries, are ground by the Roy method in their own bearings, thus eliminating the time-taking operation of removing them from the calenders.

The Roy grinders have been accepted by leading manufacturers not only because of their reliability, but also because the machines allow concerns to take care of the grinding in their own plants, thus keeping the machinery for the first important textile operation in perfect working condition at all times.

Duncan H. Dewar is president and treasurer and W. A. Underwood is assistant treasurer and general manager of the corporation.

THE MANY INVENTIONS OF OSGOOD PLUMMER

Osgood Plummer was the inventor and patentee of many appliances and machines covering woolen looms, and blacksmiths' and machinists'

tools, being awarded a patent in 1868, on harness mechanism for looms; on a new mechanical movement the following year; on a towel rack, in 1871; on an automatic heat regulator, in 1876; on a universal lathe chuck, in 1877; on an upright drilling machine, in 1878; on a blacksmith's drilling machine, in 1883, and on a telephone switch, in 1890; the most valuable and important of the group being the machine tool patent for upright drills, which from its inception became extensively used in machine shops throughout this country and Europe.

THE WHITAKER REED COMPANY

From 1869 to 1897 John Whitaker carried on the business of the Whitaker Reed Company manufacturers of loom reeds for cotton, woolen, carpet and wire cloth plants. Richard K. Hutchins is president and treasurer of the corporation, which has capital of \$30,000. Twenty-five hands are employed in its May Street plant, where loom reeds of all descriptions are manufactured, as well as belt hooks and mill wire goods.

THE PHENIX PLATE COMPANY

The Phenix Plate Company was formed in 1870 by Charles A. Hill and H. M. Hedden, for the manufacture of ferrotype plates and japanning supplies.

Today, ferrotype and squeegee plates are produced by the concern, at its Park Avenue plant, where thirty hands are employed. The corporation has capital of \$35,000. L. B. Hill is president, and Charles G. Hill is treasurer.

O. M. SAVELS & COMPANY

In 1870 the die-cutting business now conducted by O. M. Savels & Co., was established, being originally operated as Davis, Savels & Co., the present name having been adopted in 1890. In 1912, Orvis M. Savels became the sole owner. The concern erected its own plant in 1901, and twenty-five hands are employed. It is now a division of The Cutting Die & Machine Company, of America, Inc.

THE HOPEVILLE MANUFACTURING COMPANY, INC.

In 1870 George A. Bigelow and Newton Darling established the Hopeville Manufacturing Company, Inc., and for sixty years this prosperous concern, now employing 160 hands, has survived all the vicissitudes that have swept over most textile concerns, its fabrics occupying such a place in the trade as to supply it with constant orders.

Its Sutton Lane plant is modern in every respect, is equipped with up-to-date machinery, and employs 175 operatives. The corporation has capital of \$650,000. George A. Bigelow is president, Edward A. Bigelow, treasurer and manager, Florence A. Mowry, assistant treasurer and Philip H. Warren, superintendent.

THE M. J. WHITTALL ASSOCIATES

The M. J. Whittall Associates really date from 1870, when the Crompton Carpet Company was organized by George Crompton, Sr., who, with Horace Wyman, invented and patented a loom for weaving Brussels car-

pets by power, there being at that period, no power loom of that type, save the Bigelow loom, and two makes of English looms, the right to use which in the United States could not be obtained.

Matthew J. Whittall was the superintendent of the new plant, which at the outset was equipped with but sixteen looms, but in 1879, thirty-six were in operation. That year, the equipment was sold to William J. Hogg, Sr., of Philadelphia, who leased the plant, and who built a yarn mill five years later. He operated under the name of the Worcester Carpet Company and in the eighties employed 400 operatives.

In 1879, Mr. Whittall purchased in England eight Crossley Carpet looms and installed them in a leased mill, in Worcester, adding eight more looms in 1882, and in the following year he built a plant, 175 by 60 feet, two stories in height, in which he placed his sixteen looms, and added fourteen more. In 1884, an extension was erected, and twelve additional looms were installed. By 1889, when he added a two-story brick mill, 250 by 60, to increase his spinning and weaving capacity, he had built another story to his spinning plant, and named the plant The Edgeworth Mill. He was then employing 320 operatives. In 1891 he erected a two-story brick building, and also bought the plant of the Palmer Carpet Company at Palmer, equipped with twenty-four looms, and then employing 100 hands.

Six years later, his son, Matthew Percy Whittall, became associated with him. In 1901, the Wm. J. Hogg plant was bought, and the following year an addition was made to the No. 2 mill. In 1903, the old Crompton Mills were extended, doubling their capacity, and the following year a brick dye house, 235 by 75 feet, two stories high, was erected. Two years later, a six-story wool warehouse was built at the Edgeworth Mill, affording 3,000,000 pounds capacity, and a third story and tower were added to mill No. 3. In 1906, a four-story mill, 145 by 60, a supply building, and a piping and blacksmith shop, were erected, and that year the M. J. Whittall Associates were organized.

The next year the machinery of the Percy Rug Company, an Axminster plant, was bought, and in 1910 a four-story brick structure, 260 by 60 feet, and a 10,000-ton capacity coal pocket, were built, thus affording altogether 500,000 square feet of manufacturing space at the plant, and sufficient area to operate 350 carpet looms.

In 1916 the plant of the Cochrane Manufacturing Company at East Dedham, consisting of seven buildings, with a power house and office structure, was purchased, and velvet and axminster carpets are produced there by 750 operatives.

At all three plants upwards of 1,500 workers are employed. The products are Wilton and Brussels carpets and rugs and in recent years the concern has specialized on the latter, and the imitations of Oriental products designed and manufactured by the concern have been little short of marvelous.

In 1929 the concern made material additions to its plant, the cost of which exceeded \$1,000,000.

Matthew Percy Whittall is president and treasurer of the organization.

The Whittall Associates also operate the Edgeworth Mill, which produces worsted and woolen yarns for use in carpet manufacturing, and which employs 350 hands.

THE PLUNGER ELEVATOR WAS INVENTED IN WORCESTER

From 1870 to 1907 Worcester was the location of plunger elevator production, the original device having been designed by Charles Hill Morgan and Milton P. Higgins. About 1879 a company was formed to operate under the Thayer patent, which covered the telescope plunger, but it went out of business in a few years, and, in 1896, the Plunger Elevator Company was formed with capital of \$50,000 when it was decided to discontinue the production of this type of elevators at the Washburn shops, of the Worcester Polytechnic Institute, where they were conceived. In 1900 the Otis Elevator Company acquired the Worcester concern and up to 1907 operated a local unit.

THE W. H. SAWYER LUMBER COMPANY

In 1871, the late William H. Sawyer laid the foundation of the present W. H. Sawyer Lumber Company, being one of the pioneers in transporting to Worcester hardwoods from Indiana, Kentucky and Tennessee, and white pine, from Michigan, conducting distributing yards at North Tonawanda, N. Y., and Bay City, Mich., and ultimately becoming recognized as one of the leading lumbermen of the east.

When he began business, Worcester had but 42,000 population, as compared with 200,000 today, while the total valuation of all the property in the city was \$34,000,000, as against \$250,000,000 at present.

In 1898 the company was incorporated as the W. H. Sawyer Lumber Company, and during the last ten years one of the most modern fire-proof lumber plants in New England has been erected, extensive additions having been made this decade, including one which was first occupied, in 1929.

The company's plant, on Lincoln Street, now occupies a frontage of a thousand feet or more on that important thoroughfare, and extends back to the irons of the Boston & Maine Railroad Company.

The corporation has capital of \$200,000, employs 100 operatives, and while primarily dealing in lumber, it now handles all kinds of building supplies and offers a suggestive service to home-owners, including a fully equipped model house.

William H. Sawyer, son of the founder, is president, H. A. Hawkins, vice president, W. H. Sawyer, Jr., treasurer, and L. P. Smith, secretary.

THE HARRINGTON & RICHARDSON ARMS COMPANY

In 1871 Franklin Wesson and G. H. Harrington began the manufacture of a shell-ejecting revolver invented and patented by the latter, and three years later he purchased Wesson's interest and in 1874 formed a partnership with William A. Richardson, under the firm name of Harrington & Richardson.

Harrington's revolver was an improvement over any arm of its kind that had been produced up to that time, being so constructed as to cause the exploded shells to be removed by the sliding ejector, without detaching the cylinder or removing any portion of the arm, and it is probable that it represented the first successful shell-ejector used on a metallic cartridge revolver.

In 1880 the concern became the sole licensee in this country for the manufacture of the celebrated English Anson & Deeley hammerless gun, the production of which was continued for five years.

In April, 1887, the partners were granted a patent on the safety hammer, and in October, of the same year, another on the cylinder catch, which is still used. In 1889, a patent was received on a design applying to stocks, and, in 1895, one was granted on lever springs.

In 1888 the co-partnership was dissolved, and the Harrington & Richardson Arms Company was incorporated, with capital of \$75,000, and in 1893-4 the present modern factory was occupied. The original main building, 180 by 50 feet, five stories high, with a tower 28 by 37 feet, was enlarged, in 1900, by the erection of a three-story addition of 60 feet, and in 1901, by another, 90 by 50, five stories high, with a tower, 28 by 37 feet to match the original structure, upwards of 100,000 square feet of floor space being devoted to production purposes.

In 1899 the manufacture of single barrel shot guns was added, and today these and double action revolvers, both solid frame and automatic, and handcuffs, constitute the company's products, and 400 hands are employed.

E. C. Harrington is president, John W. Harrington is treasurer, and they, with George F. Brooks, constitute the board of directors.

THE REED-PRENTICE CORPORATION

In 1872, Vernon F. Prentice began the production of lathes and drills as A. F. Prentice & Company. Three years later Frederick E. Reed purchased a half interest in the concern, and, in 1877, he bought the remaining half interest and the firm name was changed to F. E. Reed & Company. Albert F. and Vernon F. Prentice then formed the firm of Prentice Brothers, and about 1890 a large foreign business was developed by the two firms, the Reed lathe achieving a world-wide reputation as the standard machine tool of its kind, while the drills of the Prentice concern became equally famous. About 1905 the latter concern brought out the geared head lathe, which met with instantaneous success.

Albert E. Newton, who later was actively identified with the Reed-Prentice Company, was granted some twenty-five patents between 1900 and 1905, covering the manufacture of lathes and devices to increase speed or improve methods of operation.

In 1912, there was effected a consolidation of the two companies, whose early history was so closely interwoven, with The Crompton Associates, the F. E. Reed Company, which had capital of \$100,000, the Prentice Brothers, the Reed Foundry Company, and the Reed & Curtis Machine Screw Company, the original capital of the merged concern, known as The Reed-Prentice Corporation, being fixed at \$2,500,000, this amount being reduced in 1914 to \$2,000,000, and later to \$624,500. The factory of The Crompton Associates was purchased, and in October, 1912, the Reed & Curtis Screw department was sold to J. Vernon Critchley, who organized the Critchley Machine Screw Company, which was succeeded by the R. B. Phillips Manufacturing Company.

At the time of the consolidation, the F. E. Reed Company employed a thousand hands, had an annual output of 2,000 machines, and occupied eight buildings, and was producing everything from heavy engine lathes to foot tables. In 1887 Mr. Reed had a force of but six men, and he built about 150 engines a year.

In 1913-14 a new automatic lathe was developed, and later a milling

machine and a profiling machine were introduced. The concern occupies 300,000 square feet of floor space and employs upwards of 500 men.

In January, 1916, the plants and assets of the Ayer Machine Company, of Ayer, and of the Brown Cotton Gin Company, of New London, Conn., were purchased by the Reed-Prentice Corporation, and a new and exceedingly powerful engine lathe was brought out by the company in 1928.

C. L. Stevens is president, F. W. McIntyre, vice president, J. J. Mackin, secretary, and C. H. Carswell, treasurer.

THE JACKSON ST., FOUNDRY, INC.

The Jackson St., Foundry, Inc., was established in 1872 by James B. Colvin, who came to Worcester from Danielsonville, Conn., and this unit, now nearly sixty years old, employs a hundred men in the manufacture of iron castings. The founder died in 1915, and W. R. O'Neil is president, and Harold F. Adams is treasurer.

In 1873, William H. Eddy began the local manufacture of planers, twist-drills, grinding-machines, stone, bolt and gear cutters, the twist-drill grinders being of his own invention. He also designed and patented a friction clutch pulley which eliminated the noise attendant upon changing belts.

THE NORTON COMPANY'S UNEQUALLED CONTRIBUTION TO WORLD-WIDE MECHANICAL EFFICIENCY AND ACCURACY

In a little one-and-a-half-story building, located on Water Street, in Worcester, in 1873, the first emery wheel, composed of emery bonded with clay, was made by the vitrifying process. Six years later, emery wheels were first produced there on a commercial basis. Thirteen men constituted the working force in the 560 square feet of manufacturing space devoted to the operations, and 15-horse-power met all requirements.

Those who assert that Massachusetts has passed the zenith of its manufacturing prowess take little or no cognizance of the events that have been transpiring in the industrial life of this Commonwealth since Francis B. Norton made his initial attempt to fabricate grinding wheels by the vitrifying process. Production of these devices has far outstripped the manufacture of all other types, while grinding has assumed a large and revolutionary place in almost countless lines of manufacture.

About 1867, an emery wheel, fashioned by employing a binder of glue and cement, was produced by the Northampton Emery Wheel Company and five years later Gilbert Hart, of Detroit, Michigan, began the manufacture of wheels by binding silicate of soda and earth clay, while the Vitrified Wheel Company, of Ashland, the same year turned out a commodity known as the vitrified wheel. These experiments suggested the possibility of producing a manufactured wheel that would supersede the sandstone variety and in this small Worcester pottery a Swedish artisan produced a solid emery wheel by the vitrifying process, using only a clay bond, and burning it in a pottery kiln.

Mr. Norton secured a patent on the invention, and by 1885 the business had succeeded to an extent that warranted the incorporation of the Norton Emery Wheel Company, which came into being on June 20, of that year, with Milton P. Higgins, George I. Alden, Walter L. Messer, Horace A. Young, and Fred H. Daniels, constituting the original board of directors. Mr. Higgins at that time was superintendent of the Wash-

burn Shops, of the Worcester Polytechnic Institute; Mr. Alden was professor of mechanical engineering at the same institution; Mr. Young was master mechanic at the plant of the Washburn & Moen Manufacturing Company, and Mr. Daniels was assistant to the general superintendent of the same concern.

In July, 1886, the erection of a two-story wooden plant, 48 by 120 feet, with basement, containing 17,280 square feet of floor space, and two kilns, was begun, at Barber's Crossing, at the junction of two divisions of the Boston & Maine Railroad, and the structure was occupied about January 1, 1887, affording, at that time, employment to thirteen men. Thereafter for a quarter of a century the manufacturing was in charge of John Jeppson, a leader of men, who had been an employee of F. B. Norton. He was succeeded by his son, George N. Jeppson, now secretary of the company.

Although the company's directors were optimistic enough to believe that this increased investment of capital in a new plant was entirely justified by the then existing conditions, they were unanimous in the thought that the two kilns installed in the new building would be sufficient to burn all the grinding wheels the world would ever use, and only a part of the new factory was employed in their manufacture. But within three years thereafter an addition of two stories and a basement was found imperative and a year later there were further extensions, including a brick office building.

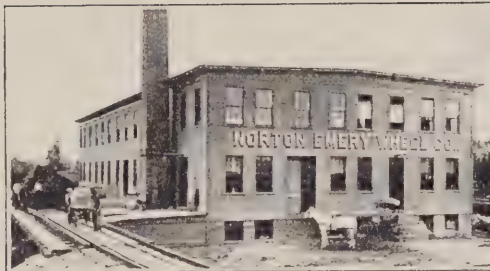
In the invention and development of any vital process more depends upon the managerial acumen of the one entrusted with the work of producing and marketing the commodity than upon the creator of the invention itself, and happily the founders of the old Norton Emery Wheel Company selected at the outset a secretary and general manager whose ability in solving the problems of an entirely new business was obvious from the start.

FOUR DECADES AND A HALF UNDER AN ABLE MANAGER

For forty-five years, Charles L. Allen, formerly bookkeeper for F. B. Norton, has continued in the capacity of general manager of the old and new corporations, and, in addition, he has successively filled at various times the important posts of secretary, treasurer, and president. It is an undisputed fact that in a very large degree the success of this corporation, and the vital part that grinding wheels have come to play in world industry, is mainly due to the far-sighted policies inaugurated, promoted and maintained by President and General Manager Allen, who is universally recognized throughout the United States as the leader in the fields of abrasives and grinding machinery.

He has witnessed the growth of the original factory, and its baker's dozen of employees to fifty-five buildings, at Worcester, containing over 2,225,000 square feet of manufacturing space, and housing 3,000 employees. In the beginning he could make his voice heard from one end to the other of the original shop, but today if he desires to inspect operations at the extreme end of the plant he can better husband his time by employing an automobile rather than by walking from what is denominated Plant 4, near Barber's Crossing, to the storage building, located beyond Plant 6, a distance of exactly one mile.

Mr. Allen was among the first of America's industrialists to realize that the leisurely tempo of living that prevailed in the closing years of the



FIRST PLANT OF NORTON COMPANY,
BARBERS CROSSING, 1886



NORTON COMPANY, WORCESTER
New Bond Street today. Plant No. 2 on left

last century, was to be superseded by speed in every phase of human endeavor, and he appreciated that the call of the hour was for inventive genius to turn its attention to the development of new tools, devices, and implements that would assist in crowding greater productivity into the average working hour of the day. He, with Milton P. Higgins, first president of the company, saw that the day of bonding emery and corundum (natural aluminum oxide) was passing, precisely as sandstone had been superseded as a grinding agent. Some method, process, or material must supplant these elements which lacked one essential feature demanded by the manufacturers, namely, uniformity in performance. Research must discover some substitute in the form of an artificial abrasive, whose crystalline formation could be controlled, thereby bringing about exact duplication in product.

THE INTRODUCTION OF ALUNDUM

Twelve years after the Norton Emery Wheel Company moved to its new plant, C. B. Jacobs, produced, for the first time in America, and at the plant of the Ampere Electro-Chemical Company's factory, at Ampere, N. J., artificial crystalline aluminum oxide, by fusing the mineral bauxite, in the then new electric furnace. This material was found to contain all the desirable and essential characteristics of the natural aluminum oxides, and later it developed that its manufacture could be controlled, making possible the desired exact duplication of grinding wheels.

Taken over by the Norton Emery Wheel Company, through the vision of Milton P. Higgins, and developed under the trade mark name "Alundum," this modern electric furnace abrasive led to the great advance of the abrasive industry and brought about a new era in machine shop practice. The success of this material in grinding hard steels and steel alloys was instrumental in inspiring the development of the modern grinding machine, and the combination of these two has brought about the ingenious mechanical devices, the marvelous production rates, the hitherto undreamed of accuracy, and the tremendous speeds of the twentieth century.

The Alundum abrasive and the consequent developments in grinding equipment made possible the modern automobile, the aeroplane, the ball and roller bearing, and countless other mechanisms which have brought comfort, luxury and ease to modern times. It made economically advantageous the use of such metals as manganese steel, stellite, vanadium steel and other tough materials which insure mechanical efficiency, safety and long life in modern mechanisms operated at tremendous speeds.

The raw materials from which Alundum abrasive is made, mineral bauxite, is a clay-like substance, usually found near the surface of the earth. Deposits exist in various parts of the world, but the principal mines in the United States now being operated are located at Bauxite, Arkansas. The mineral consists of hydrated aluminum oxide, associated with varying quantities of such impurities as silica, iron oxide, titanium oxide and small quantities of other minerals.

All of the important properties required in a modern abrasive—hardness, toughness and proper nature of fracture—are contained in crystalline aluminum oxide, and two of them, toughness and nature of fracture, may be controlled in a widely varying degree during the process of manufacture.

It is known that the hardness of Alundum abrasive ranks close to that

of the diamond. Its toughness and nature of fracture are largely dependent upon the production process. Both of these properties govern, to a considerable extent, the abrasive action of the individual crystal or particle. The degree of toughness determines its efficiency in grinding hard steels, steel alloys and similar materials and its ability to withstand the severe strain of the cutting action while moving faster than a mile a minute. Its nature of fracture determines its sharpness and its continued cutting action. As both of these can be controlled, crystalline aluminum oxide may be manufactured to suit the particular need to which the abrasive is to be subjected.

HOW THE WHEELS SERVE THE MECHANICAL WORLD

The Norton grinding wheels, in which Alundum is the cutting element, are manufactured by several processes known as vitrified, shellac, silicate, rubber and Bakelite. Present requirements call for hundreds of thousands of combinations of grains, grades and sizes in wheels which serve industry and man in countless ways.

There is hardly a machine, implement, tool, utensil or instrument used today upon which some grinding is not done. In fact, the scope of the grinding wheel and grinding machines reaches even into the production of foodstuffs and other commodities of life. The agricultural machinery which assists the farmer in raising and harvesting his crops has many parts which are ground. Some well known breakfast foods were not possible of manufacture until grinding permitted the production of the machines which fashion them.

The modern automobile engine could not have been produced on a commercial basis had it not been for the modern abrasive and the grinding machine. The aeroplane, accurate machine tools, huge newspaper presses, the radio, telegraph, telephone, woodworking machinery, office appliances, weapons, the modern automatic looms, electric motors, steel vessels, turbo-generators, and countless other commodities have been developed to their present state of efficiency since, and because of, the discovery of artificial aluminous abrasives.

Aluminum oxide possesses other properties which also make it valuable in refractory ware. It has an extremely high melting point, conducts heat rapidly, when hot does not conduct electricity, and withstands erosion and abrasion. In the laboratory, where scientific research is carried on, Alundum laboratory ware is widely used. In heat treating furnaces, in brass and copper furnaces, in power plant boilers, kilns, electric appliance heating units, Alundum products are extensively employed.

Because of its rough surface, it is also used in the manufacture of non-slip flooring, such as enters into railroad stations, public buildings, hotels, hospitals, schools, stores, theatres, and even on the edges of swimming pools.

In 1901, the first plant for the manufacture of the artificial abrasive, was built by the Norton Company at Niagara Falls, N. Y., under the superintendency of Aldus C. Higgins, son of Milton P. Higgins, and now treasurer of the company, followed soon after by the erection of another at Bauxite, Arkansas, where bauxite is mined and shipped to the Niagara Falls unit to be fashioned into Alundum abrasive.

In 1902, the first building was constructed in Worcester for the manufacture of Norton cylindrical grinding machines under the firm name of

Norton Grinding Company, with Charles H. Norton, the great inventor, as chief engineer. Charles H. Norton, whose more than 100 patents in the fields of grinding and munitions have contributed to the economic revolutions in the metal industries of the world, easily takes rank among the inventors of first importance in Worcester. He has written extensively for technical journals and has lectured on scientific subjects.

Both the abrasive plants and the grinding machine unit have since had many additions constructed, and all are today operated by the Norton Company, the corporate successor of the old Emery Wheel Company, and the Norton Grinding Company.

The grinding units produce machines for cylindrical grinding, for grinding plain surfaces, roll grinding, for car wheels, and car axles, for tool and cutter grinding and bench and floor stands.

One of the company's installations was a roll grinding machine that weighed 110,000 pounds, designed for grinding rolls 55 inches in diameter, 21 feet long, which weighed 64,000 pounds, or 32 tons. Recent developments have made possible the use of grinding wheels, with a face as wide as 15 inches.

THE UNIVERSAL USE OF THE PRODUCT

The railroad industry is greatly aided by the development of car wheel and car axle grinding machines, while the methods of rolling sheet metal have been revolutioned by grinding machinery.

In the big automobile plants, where cars are turned out like sausages from the proverbial sausage machine, one finds huge batteries of grinding machines, all devoted solely to precision grinding, performing quickly and easily work that could not be done at all before or could be done only with vastly increased costs for labor.

In fact, grinding simply has made possible this metal age, this age of machinery, this iron age that we live in. Grinding has made precision and quantity production possible at low costs.

Without the grinding process automobiles would be so expensive that only the rich could afford to use them. Not the humblest machine shop in the industrial world could operate without grinding, even though it be so small that it use grinding only for sharpening the tools used in other machining operations.

Today there are over 100 types and sizes of Norton grinding machines, including cylindrical grinding units for crankshafts, camshafts, car wheels, rolls and other types of cylindrical work, surface grinding, tool and cutter grinding, multi-purpose grinding, and floor and bench machines for snagging castings.

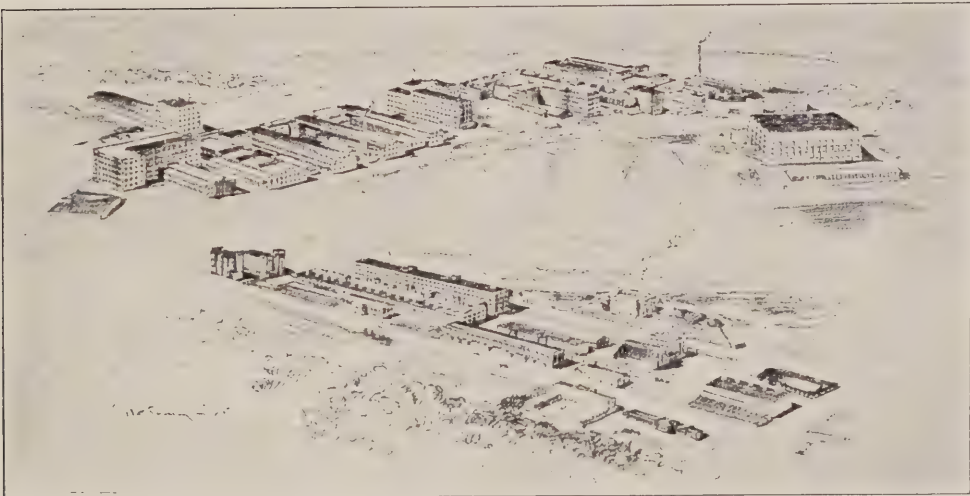
THE COMPANY ACQUIRES A COMPLETE LINE OF LAPPING MACHINES

In 1927, the Norton Company purchased the entire capital stock of Bethel-Player & Company, Inc., of Westboro, manufacturers of an extensive line of modern lapping machinery, and these products are now being produced in the Worcester plant, and marketed through the company's sales organization.

The Bethel-Player products had a world market and enjoyed an excellent reputation for quality. They consist of crankshaft lapping machines, cylindrical and flat lapping machines, hole and cylinder lapping machines, and tool room bench laps. The fact that lapping usually fol-



INTERIOR OF ASSEMBLY FLOOR,
GRINDING MACHINE DIVISION, NOR-
TON COMPANY, WORCESTER



THE NORTON COMPANY OF TODAY

lows the grinding operation made these products a logical addition to the Norton line of precision grinding machines.

Lapping machines find a market in manufacturing plants producing automobiles, aero engines, electrical apparatus, calculators, fine tools and gauges, pneumatic tools, high pressure pumps, roller bearings and optical goods. In fact, they are essential to a high standard of accuracy in all precision manufacturing.

Due to the present day demand for transportation and production machinery of high speed and extreme precision, a wide field has been developed for lapping machinery as an adjunct to grinding.

The Bethel-Player Company was organized in Westboro, in 1922, by Joseph N. Bethel and Sidney Player. In June, 1927, the company was reorganized under the name Bethel-Player & Company, Inc., and its first product was a vertical cylindrical lapping machine, which was the first commercial lapping device ever put on the market. The number of products increased from one type of lapping machine to thirteen, many of which are covered by patents and patents pending.

The inventors, Joseph N. Bethel and Sidney Player, are now a part of the Norton Company.

THE COMPANY'S FOREIGN OPERATIONS

In 1910, the company's first plant was built on foreign soil, when the Deutsche Norton Gesellschaft was organized at Wesseling, Bez Coln, Germany, and operations were started there the following year.

In 1910, a plant was constructed at Chippawa, Ontario, Canada, for the manufacture of the abrasive carbide of silicon, known by the trade mark "Cryston," and in 1920 a grinding wheel plant was erected at Hamilton, Ontario, Canada. The same year the Compagnie Des Meules Norton began operations at La Courneuve, on the outskirts of Paris, France.

Thus it is observed that during Mr. Allen's managership he has seen the Norton Company grow from the original little wooden factory to a plant of mammoth sizes in Worcester, and he has witnessed the erection of three grinding wheel establishments on foreign soil, two abrasive plants and a bauxite unit as well.

The company's sales offices and organization in Chicago, Detroit and Philadelphia, are located in Norton buildings, and offices are maintained in New York, Pittsburg, Cleveland, Syracuse and Hartford, in this country, and in London, England.

Separate sales organizations are maintained at each of the foreign plants in Germany, France, and Canada. Norton service men are available to both grinding machine and grinding wheel users in all sections of this country, and in industrial centers in Europe.

SOME OF THE COMPANY'S ACTIVITIES

The Norton Company has founded two villages—the first, Indian Hill, in 1914, visited by the late Ex-President Theodore Roosevelt, who complimented it highly, and exploited by Miss Ida M. Tarbell, who described it as being "planned for utility, economy and beauty," and Indian Hill North, constructed in 1920, when Worcester confronted a housing problem. The forty-acre Norton gardens, begun during the World War, still prevail; the Norton bathing beach, on Indian Lake, with the water car-

nivals; the annual Norton picnic, held each fall, when as many as 15,000 persons participate; the baseball park, tennis and volley-ball courts; the plant hospital, free medical service and the system of physical examinations of employees, in all of which it pioneered; the cafeteria; and the shop publication, the *Norton Spirit*, started in 1914, all attest the interest of President Allen, and his associates, in the welfare and comfort of the company's employees.

At the close of the World War approximately 5,000 men and women were on the payroll, but today, due to the introduction of manufacturing economies, the corporation produces in greater volume, with 3,000 employees than was possible with the larger number of a dozen years ago.

What a commentary on the statements so frequently made by critics of Massachusetts, unfamiliar with the facts, to the effect that we haven't invaded a new field of production in a generation, when one cites the triumphs of this concern, whose commodities have become an important, and in many cases an indispensable factor in practically every industry in the world.

It must be recalled that it did not perfect and market its first cylindrical grinding machine until 1900; it did not offer its Alundum abrasive to the world until 1901; it did not produce Crystolon wheels and allied products until 1910; it did not advertise its refractories until that year; it did not invade the fields of architecture and building, with its floorings, until 1917, and it did not add its modern lapping machines to its line until 1928.

This expansion of the Norton business and the international publicity of the name Norton has been little short of phenomenal, its foreign plants not having been launched until 1910 and 1920.

In 1929 there were erected, at the Worcester plant, an abrasive crushing mill, and an addition to the grain storage building, both structures being of fireproof construction throughout, of brick and steel. The crushing plant is five stories high, 140 feet long and 60 feet wide, and is equipped with the latest type of machinery for rapid crushing, sizing, washing, and drying of abrasive grain, and with conveyor systems which handle the material rapidly and efficiently. The grain storage addition is three stories in height, 187 by 54 feet, modernly equipped, and connected with the new crushing mill by covered bridges and conveyor systems. The expenditure represented in these new structures was in the vicinity of \$300,000.

THE COMPANY'S PRODUCTS

The Norton Company's products may be classified into four main groups—abrasives, which include grinding wheels, abrasive grain, pulpstones, and bricks and sticks; grinding and lapping machinery; refractories, and Norton floors, which include Alundum tiles, treads, and aggregates.

The basic product of the company for more than forty years has been grinding wheels, which have met the increased needs and advancing knowledge of the art of grinding, and are being extensively employed in the metal-working plants of the world.

With each stage of development of abrasives, from emery to corundum, and corundum to the several modern electric furnace products now used, there has been a like improvement in the development of the grind-

ing industry. Norton wheels today are known by the trade-marks Alundum, 38 Alundum, 19 Alundum and Crystolon—products with a wide variance in physical properties and cutting action.

Five processes are used in wheel manufacture: vitrified, silicate, shellac, Bakelite and rubber. There are wheels of many varieties and shapes for performing countless operations and for use in practically all industries. They range from 3 1/6 inches diameter to 72 inches diameter, and from 1/64 of an inch up to 54 inches thick.

Both Alundum and Crystolon abrasives, in grain form, carefully screened to standard sizes, are used in the manufacture of abrasive paper and cloth, and for polishing.

The majority of the abrasive papers and abrasive cloths manufactured in the United States are coated with one or the other of these two abrasives.

Polishing forms an important part of the production process in most industries where tools, implements, cutlery and parts of modern appliances and machines are produced. The abrasive grain is usually applied to a polishing wheel or canvas or leather belt. Polishing grain is packed in one, five and ten pound cans and in kegs up to 400 pounds. Many users of the Norton abrasives purchase in carload lots.

The Norton Pulpstone replaces the quarried sandstone used in pulp mills since the beginning of newsprint pulp. These are large segmental wheels built up by mounting and jointing vitrified segments onto a heavy cast iron drum.

Other Norton abrasive products include bricks for truing glass cutting stones, scouring castings, general foundry and machine shop work, dressing and smoothing granite and marble, scouring chilled iron rolls and work of like nature. Alundum perforated bricks are employed in rubbing down castings after filing and for rubbing down varnish and patent leather. Crystolon bricks are also made for rubbing the surface of concrete. The line of Alundum and Crystolon vitrified sticks includes a range of sizes from 4 inches to 12 inches long and from a quarter of an inch to 1 1/2 inches thick. Bricks and scouring blocks are furnished in the variety of sizes necessary to meet modern requirements.

The Norton machines for grinding round work, known as Norton cylindrical grinding machines, were introduced in 1900. In thirty years the Norton line has grown until it now includes machines for a variety of grinding operations. There is a total of approximately 100 sizes of the several types, and the number of different parts making up these machines is around 20,000.

Norton Lapping Machines comprise types for cylindrical and flat parts, a universal type for tool rooms and a crankshaft machine for crankpins and bearings.

Alundum and Crystolon refractories and laboratory ware have reached a high state of perfection. Both abrasives, when made into bonded articles, impart the characteristics of resistance to softening at high temperatures, high thermal conductivity, and low electrical conductivity.

Norton floors include semi-vitreous, Alundum floor and stair tile, Alundum ceramic mosaic tile, and Alundum aggregates for terazzo, cement, and asphalt floors; and Precast (manufactured by licensees), which includes aggregate tile, treads, thresholds and platforms.

The semi-vitreous products are especially adapted for industrial

plants, subway and railroad stations, schools and other public buildings for stairs, ramps, landings, elevator thresholds, corridors, and all places where a permanently slip-proof, fire-resisting and wear-resisting floor is desirable. Precast aggregate products contain marble chips, cement bonded with Alundum aggregates, and are manufactured precast to the architect's detail. This provides a slip-proof floor that may conform to the harmony of any building, and the possible color combinations are practically unlimited, being adaptable to all types of stair construction.

The Norton Company has capital of \$14,000,000. Charles L. Allen is president; George N. Jeppson, secretary; Clifford S. Anderson, assistant secretary; Aldus C. Higgins, treasurer, and Henry Duckworth, assistant treasurer.

THE INVENTIONS OF WILLIAM T. AND ELBERT H. CARROLL

William T. Carroll, while living in Medway, invented a new type of spinning ring, which was bought by the Draper Corporation, of Hopedale, and, in 1874, he removed to Worcester where he remained until 1905, devoting much of his time to experimental machine work, and receiving upwards of fifty patents on improvements and new inventions in the field of cotton machinery, nearly all of them being bought by the Draper Corporation. He was the inventor of the oilless bearing patents acquired from him by the Massachusetts Oilless Bearings Company, and in 1896, Mr. Carroll was awarded the John Scott Medal for his non-metallic bearings, upon the recommendation of the Franklin Institute. His son, Elbert H. Carroll perfected improvements in spinning machinery upon which he received patents at the age of seventeen years, and recently he has been the recipient of many patents upon new, valuable and important inventions and processes.

THE J. W. BISHOP COMPANY

In 1874, John W. Bishop, founder of the present J. W. Bishop Company, began the business of contractor and builder, and from 1879 to 1893, he was associated with George H. Cutting, under the firm name of Cutting & Bishop. In 1893, the J. W. Bishop Company was formed, which was incorporated, in 1899, with \$400,000 capital, and today it employs from 500 to 1,500 skilled men, and maintains branches in Boston and New Bedford, John W. Bishop being president and general manager, and Herbert N. Leach, treasurer and secretary.

THE WILLIAM ALLEN SONS COMPANY

The William Allen Sons Company was established in 1875 by the late William Allen, and today occupies a substantial two-story brick building, boiler shop and foundry on Green Street, in the manufacture of tubular, locomotive and marine boilers, and bleaching kiers and in carrying on general iron work.

Walter B. Allen is president and treasurer; Louis H. Elliott, is vice president and general manager, and Walter D. Allen is assistant treasurer. The corporation has capital of \$34,000, and employs forty operatives.

THE DAVIS PRESS, INC.

In 1875 a small office was outfitted with the requisite materials, and a new print shop came into being in Worcester, having as its modest slogan,

"Good Printing." In the intervening fifty years, The Davis Press, Inc., has grown until it now occupies an entire floor, and from a force of two men and a "devil," it regularly employs fifty hands in its completely equipped printing and publishing establishment.

In 1890, Gilbert G. Davis purchased the interest of his partner, George L. Sanford, in the firm of Sanford & Davis, and operated under the name of The Davis Press. The concern was incorporated three years later.

Foreseeing the need of being more than just printers, The Davis Press was one of the early plants to install a service department that could analyze a client's merchandising problems, suggest copy and layout, and deliver finished advertising material of outstanding quality.

In addition to the printing of catalogs and direct mail advertising, The Davis Press is the owner and publisher of "The School Arts Magazine," a monthly journal which is the acknowledged leader of its field, and with a national distribution among students, teachers, and followers of art and design. In connection with it have been published interesting art text books.

M. W. Davis is president, R. M. Spencer, vice president, Alliston Greene secretary, and Warren G. Davis, treasurer.

In 1875, the shoe firm of Childs, Smith & Company was established, which, in 1891, became H. E. Smith & Company. The well known brand of shoes, known as "Nox 'Em All," was originated by the parent concern and an annual business of \$600,000 was built up within a few years.

THE PERO FOUNDRY COMPANY

It was in 1877 that Prespey Pero located his foundry on Hermon Street, where he manufactured machinery and tool castings. The concern is now capitalized for \$50,000, and employs twenty-five hands in the production of grey iron castings.

Mark N. Skerrett is president and treasurer, and Edward L. Moore, is clerk of the corporation, which operates under the name of the Pero Foundry Company.

THE MILLS BELT COMPANY

Capt. Anson Mills, of the United States Army, who invented in Paterson, N. J., in 1877, the Mills woven cartridge belt, came to Worcester in 1880, to interest local capital in his device, and on December 20 of that year, received two patents, one on the woven belt and the other on the loom for weaving the cartridge belt fabric. Until the outbreak of the Spanish-American War, the business was confined to making belts for sportsmen, with now and then a small order from the United States Army, but, in 1898, a larger plant was taken over, and, in 1909, the present factory was built. The business has been materially expanded by the invention and manufacture of many articles of equipment, for which improvements in small arms and the steadily mounting costs of leather have created a demand, until today many forms of equipment are turned out at the plant. The company's sales have now extended to foreign countries, Great Britain having been the first nation abroad to adopt the Mills system for the equipment of its soldiers. The concern, now known as the Mills Belt Company, which started in 1880, with half a dozen employees, and which possessed but ten looms up to 1898, now employs 300 in busy

times and operates over 100 looms. It has capital of \$50,000. Frank Roe Batchelder is president, and Eugene A. Sisson, treasurer, of the concern.

THE COATES CLIPPER & MANUFACTURING COMPANY

The Coates Clipper & Manufacturing Company, now owned by Howard Reed, and engaged in the manufacture of hair clippers and flexible shafts, employing sixty operatives, was established in 1877, by G. H. Coates, and was incorporated in 1894, with capital of \$15,000. Albert W. Darling is president, Howard Reed, treasurer, and M. Clifton Nelson, secretary.

THE HARWOOD QUINCY MACHINE COMPANY

In 1878 E. H. Wood, of Worcester, began to manufacture for Messrs. Harwood & Quincy, of Boston, the Bramwell folder, invented by W. C. Bramwell, of Terre Haute, Ind., used for feeding wool to carding machines, and an invention which revolutionized the business and proved to be a great factor in the development of the wool-carding industry. In 1881 the Harwood & Quincy Machine Company was formed, and a plant erected where the Bramwell patent, which had been bought by the concern, was manufactured.

The corporation today known as the Harwood Quincy Machine Company has capital of \$60,000, employs upwards of seventy-five operatives, and produces textile machinery in its Lagrange Street factory, maintaining its headquarters at 53 State Street, Boston, under the name of George S. Harwood & Son, the partnership being made up of Sydney and John H. Harwood. The officers of the machine unit are John H. Harwood, president, Bartlett Harwood, clerk and Sydney Harwood, treasurer.

THE LOWELL WRENCH COMPANY

The Lowell Wrench Company was established about 1880 to manufacture the Lowell reversible ratchet wrench, a tool that during the intervening half century has become internationally known.

Starting with one pattern capable of handling but a few sizes of nuts, this line has been developed to the point where it is now the most complete of its kind in the world.

Its capacity range is at present such that it can handle nuts or shanks from one-half inch across the flats to those as large as six inches in this dimension, the former calling for a wrench weighing one pound, while the wrench of the latter specification weighs nearly 60 pounds. Thus from the smallest with its handle seven inches long to the largest with its eight-foot length, the Lowell line offers a wide range from which to choose.

The Lowell wrench is a tool which has been successfully used in some of the larger undertakings of the day such as in the construction of the Hudson River Vehicular Tunnel recently opened to traffic. This tunnel consists of cast iron sections, bolted together to form the tube which extends under the river at New York, many thousands of bolts being used in the work. A special pattern of the Lowell wrench was employed exclusively in bolting the sections together, with the consequent saving of a great deal of time and labor.

In the oil industry, the Lowell wrench is to be found at work in one pattern or another from the point of installation of the pipe line (often 100 miles or more long), to within the refinery itself.

The railroads recognize the time-saving features of the reversible ratchet, and use it in their shops, in their road departments, in their bridge and building gangs, in the unloading of coal cars, and in many other ways.

Builders of various lines of equipment, machine tools, and other mechanical devices are constantly equipping their plants with the Worcester product.

The large valves of power-houses are being opened and closed with these wrenches, instead of the usual hand wheels, and they are also in use with ash handling systems, two prominent manufacturers of this type of equipment having adopted them as a standard accessory to their product.

The retreaded tire which may be running on your car came in contact with the Lowell wrench when it was clamped in the vulcanizing mold. The steel towers supporting the power transmission lines extending across the country are erected with this tool, while the gates of the water projects are raised and lowered with it, and the penstocks which conduct the water, perhaps for many miles, are assembled on the job by the Worcester product.

The Lowell Wrench Company also produces drills and die stocks and hand and jewelers' pin vises, and has capital of \$72,814. John H. Dodge is general manager and assistant treasurer of the corporation.

THE WASHBURN COMPANY—WIRE GOODS DIVISION

In 1880 the late Hon. Charles G. Washburn began the manufacture of wire goods for cotton and woolen machinery, under the name of The Wire Goods Company, and eight years later the Ayres Manufacturing Company was absorbed. The company utilizes approximately 150,000 square feet of floor space, and is now the Wire Goods Division of The Washburn Company, which concern is capitalized for \$1,000,000, employs 250, and maintains another plant at Rockford, Ill., and a branch office in Chicago, the line of product having been greatly broadened until it includes stamped and metal hardware and kitchenware, thousands of items appearing in its catalogs. The capital stock and assets of the E. Jenckes Manufacturing Company, of Pawtucket, R. I., producers of wire hardware, and of the Woods-Sherwood Company, of Lowell—the oldest concerns in the country manufacturing kitchenware—were absorbed some years ago and the operations removed to Worcester.

Reginald Washburn is president and treasurer and Irving A. Green is secretary, of the corporation.

THE WORCESTER WOOLEN MILL COMPANY, INC.

The Worcester Woolen Mill Company, Inc., was formed in 1881, when the plant built by Eli Thayer, in 1854, for gun work, which was used, in 1861, for soldiers' barracks, and was subsequently bought by Jordan, Marsh & Company for a woolen mill, was purchased and occupied. At that time the mill was one of the largest woolen factories in the state, being 582 feet long, and 42 feet wide, with two wings, one 72 by 60, and the other 90 by 56 feet. In 1890 the concern, which was then managed by John Legg, Sr. and Edward D. Thayer, Jr., was incorporated, and upon the death of the latter, in 1907, Mr. Legg and the late Frank S. Fay acquired control.

In 1916 a large preparation plant was added, and overcoatings, cloak-

ings and uniform cloth have constituted its products, the latter being accepted as United States standard fabrics. The plant is equipped with seventeen sets of cards, seventy-six broad looms, 4,896 woolen spindles, six pickers, complete dyeing and finishing departments, and three boilers.

The corporation has capital of \$90,000, and employed upwards of 375 people up to the time of its voluntary liquidation, in 1929.

John Legg is president, Hon. Rufus B. Dodge, vice president, J. Francis Legg, treasurer, and William M. Mitchell, superintendent.

It is anticipated that a new corporation will succeed the former enterprise and that the plant will resume operations and produce a different type of goods.

THE BICKNELL AND SNYDER ENTERPRISES

The J. F. Bicknell Lumber Company was founded by John F. Bicknell, in 1882, and specializes in manufacturing the Bicknell folding ironing table, as well as in lumber and mill work, Roscoe G. Bicknell, son of the founder, being president, treasurer and secretary of the corporation.

It is capitalized for \$30,000 and employs twenty-five men.

John E. Snyder began the manufacture of upright drills in 1882 and ultimately became the only producer in the country engaged exclusively in the distribution of upright drills. In 1904, Milton C. Snyder, son of the founder, became identified with the corporation, at which time it became known as John E. Snyder & Son, and he is its treasurer. Fifty hands are employed.

THE WORCESTER PRESSED STEEL COMPANY

The Worcester Pressed Steel Company, under its present corporate name, is another example of twentieth century industrial progress in the Heart of the Commonwealth. It succeeded the Worcester Ferrule & Manufacturing Company, which was organized in 1882, by two Worcester mechanics and an inventor who, by hard work, enterprise, and the application of the mechanical genius they possessed, struggled along from a small start in 1868, when they obtained the initial patents for developing a process of working metal which comprehended covering the drawing of seamless ferrules from sheet metal, by the use of dies and punches in a punch press.

At the outset twenty hands were employed, and 8,000 square feet of manufacturing space were occupied, at 17 Hermon Street.

In 1894 the concern developed the manufacture of bicycle frame fittings in pressed steel, which process completely revolutionized the cost of production at that period, when the manufacture of bicycles was in the heyday of its glory. Its contribution to lowered costs in this field was paralleled by its pioneering activities in developing the pressed steel ball cups for ball bearings used on bicycles and roller skates, and later in the automotive field. It was in 1894 that enlarged production demanded the removal of the concern to larger quarters, and a plant was taken at 100 Beacon Street. In addition to its contributions to bicycle production, the company was then manufacturing steel and brass stove trimmings, patent nickel-plated knobs, hinge pins, towel racks, foot rails, steel, iron and brass ferrules, and nickel-plated steam pipe collars.

With the incorporation of the Worcester Pressed Steel Company, under the laws of Massachusetts, in 1904, the concern immediately expanded

and moved to a thirty-acre location, adjacent to the Boston & Maine Railroad tracks near Barker's Crossing, and the next year erected and equipped a modern plant, 200 by 90 feet, two stories high, in which special machinery was installed. The new corporation purchased the first oxy-acetylene autogenous welding plant ever made in the United States for commercial purposes, and added every new and practical device that later was invented for autogenous welding purposes.

In 1908, the corporation established a department for cold rolled shearing and pickling strip steel, and the following year added a building, 125 by 35 feet, for annealing and case hardening, and an iron foundry for semi-steel castings.

In 1910 a two-story building, 90 by 100 feet, was built, and two years later a mill for pickling steel and stampings was erected, 69 by 108 feet, and eight additional acres of land were acquired for future developments.

In 1913-14 a new building, 100 by 90 feet, was constructed of monitor fire-proof steel construction, metal sash and glass, in which was installed a new rolling mill—the only three-high cold rolling mill in the United States, while the most modern equipment for the economical and efficient rolling, shearing, straightening, polishing, slitting and coiling of cold rolled steel, was installed.

In order to efficiently manage the cold rolled steel department, which had grown by leaps and bounds, the Worcester Strip Steel Mills Company, a subsidiary controlled by the Worcester Pressed Steel Company, was formed, with John W. Higgins as president and treasurer.

To develop, manufacture and market a pressed steel pulley, which had been conceived by the officials of the Worcester Pressed Steel Company, there was also formed the Worcester Pressed Steel Pulley Company, whose stock is controlled by the parent organization, and Mr. Higgins became the executive head of this subsidiary enterprise.

In less than twenty-five years the Worcester Pressed Steel Company developed into a million dollar corporation, retaining all the while the cardinal principle upon which its success was built, that of directly serving other manufacturing lines such as textile, electrical, farm and dairy, motorcycle, automobile, oil burning, aeroplane, radio, and other metal industries. The Worcester plant is completely equipped with powerful modern machinery of the highest efficiency for producing pressed steel parts in competition with parts machined from drop forgings and castings. Pressed steel gains its market impetus largely because it is a much lighter and stronger product, more easily finished, and can be produced at a fraction of the cost of other methods of manufacture. Such parts as are fabricated with dies and punches in presses are produced in duplicate at high speed, thus effecting a saving of labor and material, and resulting in real economies.

Twice each decade since 1904 the concern has doubled its plant capacity, and invention and adaptation of new methods, with the addition of new machinery, have had complete sway. The presses now in service range from small high speed models for fast, light work, to mammoth double action, toggle presses of 1,000 tons pressure, with a stroke of 26 inches, and using a blank 48 inches in diameter. The company has designed and built over 16,000 sets of dies and punch tools, which have produced upwards of 200,000,000 stampings that have been delivered to manufacturers all over the world.

In 1927 the company spent more than \$100,000 for new equipment and it is always abreast, if not ahead, of the times, in its field.

There was installed the same year a high speed V. & O. automatic press that shoots stampings out at the rate of 150 pieces per minute, four times as fast as the capacity of ordinary hand-feed presses.

In the tool department there has been installed a Keller profiling machine, which finishes a die in $2\frac{1}{2}$ hours, where under ordinary conditions of manufacture, it would require 35 hours time. This machine works automatically to within .0001 inch, and is operated by five separate motors, all of which are controlled from a central switchboard.

The company's cold rolled mill has a weekly capacity of 200 tons, ranging in thickness from .005 inch to .500 inch and in widths from $\frac{3}{4}$ inch to 13 inches. This mill now supplies cold rolled strip steel to other concerns making pressed steel parts.

Unique, indeed, is the record of the Worcester Pressed Steel Company, and its predecessor, the Worcester Ferrule & Manufacturing Company, in that the two units have been in operation for forty-eight years, with never a shutdown, a fire, a strike, or a failure. Its operations are carried on in a series of structures having a capacity of 200,000 square feet of manufacturing space, and two private side tracks leading to the main irons of the Boston & Maine serve its transportation needs.

Its executives are broad-gauge industrialists who have nothing to hide and visitors are always welcome at the plant, which is in constant operation rolling and pressing all kinds of metals and alloys into money-saving products for the thousands of customers it serves in this country and abroad.

During the World War, the Worcester Pressed Steel Company produced upwards of 150,000 steel helmets, which were worn by the boys of America on the battlefields of France, and it is an interesting commentary to note that more armor was used by the soldiers who served in that war than in any other period of history, thus indicating that armor is by no means extinct, though it is no longer jeweled as in the older days.

The Worcester Pressed Steel Company has capital of \$600,000 and employs upwards of 300 operatives. John Woodman Higgins is president and treasurer, and Arthur P. Higgins is secretary of the corporation.

THE JOHN W. HIGGINS INDUSTRIAL MUSEUM

While the phenomenal progress of the concern has been due to the vision and business ability of John Woodman Higgins, he has not become so self-centered as to lose sight of the fact that there is something more involved in his enterprise than the mere mass production of pressed steel commodities. He is firm in the belief that there is a beauty and an artistry, even in the cold and austere appearance of modern steel, as there were in the days when metals were fabricated exclusively by the hands of master craftsmen.

From his earliest years Mr. Higgins has been a student of the art of metal working, and unlike many of his contemporaries in the industry, he chose to study its backgrounds, and to note its development down through the centuries. His interest in the subject resulted in his making many trips to Europe, where it had its beginnings, and he began to acquire specimens and to preserve the study of its literature until eventually he became the possessor of a collection of metal products that runs

the gamut from relics of the Stone Age down through the production of arms and armor from the dawn of history to the Christian era, and on to the Dark Ages, the Renaissance, and to the World War era, with its "tin hats" and its battleship plating.

While he has acquired some thirty odd suits of mediaeval armor, with innumerable smaller specimens, making his acquisitions by far the largest collection of its kind in New England, and among the more notable ones in the world, he feels that he has but scratched the surface, and he hopes to devote the remaining years of his life to the amplification of his hobby.

His frequent visits to the industrial museums of the Old World convinced him of the immense influence exercised by these institutions in stimulating skilled craftsmanship and in inspiring a love for the arts of steel, which almost daily are attaining new developments. He reached the conclusion as the result of his studies that the close intimacy between art and industry justified him in establishing in Worcester a museum where his collection might be housed, and thus serve as an inspiration to the artisans of Massachusetts to take a greater pride in their work, and to glimpse visions of even a more brilliant future for the metal-working industry than they had been permitted to obtain in the every-day environment of the factory.

And so in the spring of 1929 he erected on Barber Avenue, adjacent to the plant of his company, a magnificent museum, with a ground floor space 200 by 50 feet, the upper half of the five floors being devoted to the museum and library.

In thus locating the structure near his shops, instead of in the heart of the city, his idea was to render it easily accessible to his own and other workmen and their friends, and with the thought of inspiring the younger generation to recognize the dignity and beauty of their fathers' craft, and thus become interested in it, for its artistic value, rather than as a means of earning a living.

In commenting upon the idea Mr. Higgins has said:

"In the mass production of cheap utilitarian articles, we have lost sight of the fact that 400 years ago our predecessors were artists, and that masters like Michael Angelo and Cellini were as much interested in designing steel armor as they were in sculpture and painting. We want to bring back that pride of craftsmanship which the guilds once fostered, and that union of art and industry which for the time we seem to have lost. There is a demand in America today for beauty in every department of manufacture, and we are beginning to realize this and to try to meet it. Sheet steel is now used in our household utensils, in our agricultural implements, and our automobiles are ninety per cent stamped sheet steel. We are using it more and more all the time. My desire is to show that with the perfection which we are attaining in making steel parts, both strong and cheap, we can and should make them also beautiful. The time will come, I am sure, when we shall see new masterpieces—not only in painting and sculpture, but in everyday things—bathtubs, gas ranges, automobiles. There is no reason why they should not be as beautiful in proportion and in ornamentation as were the articles turned out by the craftsmen of the middle ages.

"So by exhibiting these products of the guilds and showing that they had equal standing with the arts, although they were utilitarian, I hope to help bring the fine arts back into our craft."

The museum and library has a background of period furniture with the tapestry, stained glass and sculpture appropriate to the type of exhibit, whether Gothic or Renaissance. In the library there are books, manuscripts and illustrations on methods of working metal from the earlier times, but having to do largely with medieval armor. In carrying his ideas into execution, Mr. Higgins has placed in the museum and the library authentic historical objects showing the progress of the mechanic arts, more particularly the metal industries, and most particularly those having to do with the use of sheet steel.

THE HOLYOKE MACHINE COMPANY

The Holyoke Machine Company, which began business in Holyoke in 1863, established a branch factory in Worcester, in 1882, where it manufactures turbine water wheels, power transmission machinery, shafting, gears and clutches. The corporation has capital of \$400,000 and at the Worcester and Holyoke plants it employs upwards of 300 skilled operatives. H. J. Frink is president and treasurer, and H. L. Frink, is secretary.

THE WYMAN-GORDON COMPANY

In 1883, H. Winfield Wyman, son of Horace Wyman, the renowned collaborator with George Crompton, in the development of looms, and Lyman W. Gordon, son of another of Mr. Crompton's associates, and both graduates of Worcester Polytechnic Institute, the former in the class of 1881, and the latter in the class of the following year, formed the partnership of Wyman & Gordon, and began, with two employees in a one-story wooden building, 40 by 60 feet in size, the manufacture of drop forgings, one worker making the dies and the other the forgings.

The partners shared the duties of engineer and fireman, and like most successful manufacturers were the first to arrive in the morning and the last to leave at night. The initial products entered into the production of looms, such as crankshafts and shuttle box binders. The original plant equipment in the Bradley Street building, where operations began in December, 1883, included two small drop hammers, an ancient helve, or trip-hammer, a planer, a lathe, a die sinking machine, and a drill.

In 1885, the partners began the production of shuttle irons, or trimmings for loom shuttles, including shuttle-tips, shuttle and bobbin spindles and springs, both in the shape of forgings and the finished product as well. Six years later the manufacture of steel car coupler knuckles, which superseded the old link and pin for coupling railroad freight and passenger cars, was begun.

That this was a fortunate circumstance in the evolution of the concern is indicated by the fact that it was in the manufacture of these forgings that the partners discovered the necessity of developing a toughening or heat-treating process that would eliminate forging strains and brittleness which caused excessive breakage in use.

They devised a method of heat-treating the forgings they produced so as to render them practically as well as theoretically indestructible, and from their experiments was developed the first commercial system of heat-treating of materials, now in general use in America, and so essential in the vital parts of the automobile and other products of this day and generation.

With the advent of the bicycle craze in the early '90s the company increased its working force to forty men, and it soon became noted for the high quality of the forgings used by the manufacturers of bicycles, with the result that these products formed the major part of its output for several years.

In 1894 the concern engaged in perfecting and producing for the Washburn & Moen Manufacturing Company copper rail bonds used in the bonding of the rails of electric railroads.

THE PARTNERS BELIEVED IN PREPAREDNESS

In its early days the automobile was derided as a "rich man's plaything," "a fool product," and many industrialists of that era dismissed it from serious consideration as holding potentialities that they might capitalize to their advantage.

Not so with the Messrs. Wyman and Gordon. They perceived it was not an expensive toy for the idle rich, but a public utility of unusual importance, and the genesis of a gigantic business. They appreciated the great benefit it would confer upon the commercial world, as well as the happiness it would bring the pleasure seeker, and no amount of ridicule could swerve them from their purpose to be prepared for production of the essential parts their concern was equipped to manufacture.

When the demand came it found the Wyman & Gordon plant thoroughly equipped and with not a department but what had been remodeled and specialized to play its part in the growing business, and that is the reason why the corporation is supreme today in the manufacture of drop forged parts for automobiles.

It was in 1902 that Messrs. Wyman & Gordon turned out the first forged crankshaft for a passenger vehicle. Their experience of nearly twenty years gained in the various lines of production they had carried on, particularly the pioneer work they had accomplished in the field of heat treatment, enabled them to at once assume a commanding position in supplying the urgent needs of the automotive industry, and gave them a leadership that has never been surrendered.

The plants of the present-day Wyman & Gordon Company in Worcester and Harvey, Ill., represent the largest drop forging industry in the world, and The Wyman Gordon Company manufactures seventy-five per cent of all the crankshafts that enter into the automobiles of American manufacture today.

Complete chemical and physical testing laboratories were early established by the concern, and a specialty was made of crankshafts, gears, axles, steering knuckles, and other parts used in the automotive industry.

In 1894 the concern was occupying floor space of 13,000 square feet; today the area devoted to manufacturing operations in the Worcester plant is in excess of 250,000 square feet, and upwards of 1,200 hands are employed. Its products now enter the automobile, aviation, truck and motor boat industries in constantly growing volume.

Heavy steam hammers running up to 12,000 pounds in weight and hydraulic presses of 1,200 tons and more capacity, have supplanted the primitive and obsolete machinery of the '80s.

The corporation has capital of \$6,600,000. George F. Fuller is president, Harry G. Stoddard is vice president and treasurer, and Charles C.

Winn is assistant treasurer and secretary. Mr. Wyman died in 1905, and Mr. Gordon, in 1914.

Here again the analyst of industrial Worcester has the fact borne in upon him that had it not been for the accidental meeting, in a Boston hotel, in the early '40s, of William Crompton, then of Taunton, and Samuel Davis, of Worcester, not only the loom and carpet industries of the city, but the Wyman-Gordon Company as well, might never have existed, and the manufacturing prowess of the city would have been far different from what it is today.

THE WORCESTER ELECTRIC LIGHT COMPANY

The Worcester Electric Light Company was organized in December, 1883, with capital of \$100,000, and began business in February of the following year, the gross revenue for the first eleven months of operation being \$31,446.

Early in 1929, when the concern had capital of \$2,400,000 and employed 350 operatives, it was sold to the New England Power Company.

At that time the local company was supplying 88 per cent of the city's industries with electric power, and the month before the transfer the customers consumed 5,550,000 kilowatt hours, as compared with 5,000,000 kilowatt hours in the corresponding month of the previous year—a gain of over 10 per cent.

THE COMMONWEALTH PRESS

Since 1883 the Commonwealth Press has been catering to the business demands of Worcester County and its environs, and the constant growth of the concern justifies the assertion that it has rendered its constituency dependable service for almost half a century. To make good customers its good friends and to retain them through two business generations can scarcely be attributed to sheer luck, and the officers of the company take pride in the fact that they have grown mentally and that their institution has expanded physically during the rapidly changing times.

Specializing in direct mail advertising, which it plans, prints and mails, the company has kept a sharp eye out for every new and attention-arresting effect in the field of world advertising, and some years ago, becoming convinced that there was looming very definitely on the business horizon the development of the process of water-color printing, it offers its clients the benefits of the Jean Berte process, which was invented, developed, and patented for the purpose of giving to color printing the more life-like quality of the original water color drawings, and the use of which has demonstrated with conspicuous success to leading business houses in many varied lines that it is a method well worthy of general use.

The Commonwealth Press has capital of \$175,000, and employs upwards of seventy-five operatives in its Worcester plant. Hamilton B. Wood is president and treasurer of the corporation.

THE WILLIAM H. BURNS COMPANY

The William H. Burns Company was established in 1883, as Baker & Burns, and for many years the concern annually cut and made up into women's underwear over 2,500,000 yards of cotton cloth, produced in the textile mills of Lawrence, Lewiston and Providence. The enterprise is now operated as a partnership, David M. and Louis Israel being the own-

ers. One hundred hands are employed in the Front Street plant, and the concern maintains a New York office, at 1182 Broadway.

THE WORCESTER STAMPED METAL COMPANY

Proof that competition was the life of trade a hundred years ago even as it is today is not wanting. As far back as 1829 entrepreneurs were engaged in the stamping business in the Heart of the Commonwealth.

On August 5, 1829, there appeared in the advertising columns of the Massachusetts *Spy* an offer on the part of a local manufacturer to make washers of the best quality of any size up to 2½ inches. Not only was he imbued with a desire to carry on this type of production, but he defied local or other competition in no uncertain terms, by adding these words to his announcement: "We are determined not to be undersold by any *opposition* establishment."

That challenge governs the local stamping manufacture of today, even as it did a century ago, when not a mile of railroad irons had been laid down on the soil of the Bay State.

Worcester continues to boast, among her metal stamping concerns, firms well abreast of today's stirring times. Their prudent and discriminating managements, by the use of up-to-date machinery and equipment, and by the employment of skilled and competent workmen, have achieved a low overhead, which places them in a position that enables them to defy "opposition establishments" in the manufacture of accurate, difficult, high grade, special stampings.

In 1883 J. Fred Wilson, a graduate of the Worcester Polytechnic Institute, established the metal stamping business carried on by the Worcester Stamped Metal Company. A few years later George A. Smith entered the same field, operating as the George A. Smith Company and later he and Mr. Wilson joined forces, and carried on business as Wilson & Smith. This concern soon had a country-wide reputation for the quality of its special washers, nuts, and flat stampings.

In 1906 Harry R. Sinclair, a graduate of Worcester Polytechnic Institute, in the class of 1896, bought Smith's interests, and the name of the concern was changed to the W. & S. Manufacturing Company, and four years later he purchased the remaining interest, and became the sole owner of the business. Harold O. McCauley was named as purchasing agent at that time.

In 1912 Frank E. Billings entered the company, and under his supervision the manufacture of deep drawn work and difficult stamped parts in all metals was begun.

In 1916 the business was incorporated as the Worcester Stamped Metal Company, with capital of \$150,000. The officers are Harry R. Sinclair, president; Frank E. Billings, treasurer and general manager; Harold O. McCauley, secretary and purchasing agent.

The plant, which is thoroughly protected by a sprinkler system, has been thrice extended, new and heavier machinery has been added, and in order to safeguard continuous production a separate, fireproof, steel annealing house was built. The press shop, tool, die making, and annealing facilities are up to the minute and equal to the demands of a steady increase in the volume of business.

The firm now employs upwards of 100 operatives. The presses, mostly special, with an unusual range of stroke and tool space, have capacities

from the lightest up to 400 tons, and deep drawn stampings are made in any metal and from stock up to 5/16 of an inch in thickness.

The variety of work done is amazingly diversified, and includes special stamped parts for the manufacturers of automobiles; motor truck transmission and motors; tractors; automobile accessories—horns, magnetos, starters, speedometers, clocks; oil engines; steam engines and turbines; marine and airplane engines; steam pumps, gas and oil pumps; electric motors; armatures; drills, appliances, and soldering irons; radios; machinery for metal working—lathes, drills, grinders; wood-working; textile; leather; package sealing; pulverizing; envelopes; vending; washing; fire fighting apparatus; automatic sprinklers; glass; and dairy machines. Parts for air brakes, ball bearings, bath room fixtures, house appliances, bicycles, motorcycles, velocipedes, clothes dryers, clutches, furniture, garden implements, chain links, conveyors, gear blanks, medical, surgical, dental equipment, and sterilizers, show cases, sporting goods, skate rolls, skylights and sidewalk lights, stoves, toys, trunks, typewriters, vacuum cleaners, wrenches, and tools are also manufactured.

THE WARREN LEATHER GOODS COMPANY

In 1883 the Warren Leather Goods Company was established in Boston by James J. Warren, as the J. J. Warren Company, and was removed to Worcester, in 1887. In its original factory in the Hub it manufactured the first suitcase ever produced and sold in the United States. The idea was suggested by a Boston trunk maker and was an evolution of the old regalia case used by members of Masonic orders. The success of the suitcase was instantaneous and for some time these commodities were made solely by the company, which takes rank as being one of the oldest manufacturers of leather goods in the United States.

Its products today embrace suitcases, bags, and leather novelties, and it employs upwards of 300 operatives, in its factory, on Austin Street. Originally incorporated, in 1902, with capital of \$30,000, it was reincorporated in 1916, with capitalization of \$300,000.

Bamford Elliott is president, H. B. Hoppin, secretary, and F. H. Kendall, treasurer.

THE HAMBLIN & RUSSELL MANUFACTURING COMPANY, INC.

The Hamblin & Russell Manufacturing Company, Inc., is the outgrowth of the firm of Samuel Ayers & Son, which, in 1883, owned about \$750 worth of stock and machinery, then located in a small shop, on Front Street. Samuel Ayers was of an ingenious turn of mind and invented and fashioned most of the tools and devices he used in wire working. He is said to have been the first man to press a corn-popper into shape from wire mesh cloth, and in the eighties it was his custom and that of his son to make up a quantity of wire products, then shut up shop, and peddle the articles, from house to house.

At that period, F. H. Hamblin was a concert pianist and instructor in the Petersilea Music School, in Boston, a rival institution to the New England Conservatory of Music, and among some of his famous pupils were his nephew, B. Harold Hamblin, now teacher of music in the public schools of Boston; William T. Miller, who became president of the Henry F. Miller & Sons Piano Company; Miss Amy Brooks, the well-known writer and illustrator of children's stories; Mrs. William Morris Hunt,

wife of the famous American artist, and her daughter, Mrs. Mabel Hunt Slater, one time owner of the Slater Building in Worcester, and identified with the Slater Mills, Inc., of Webster.

F. H. Hamblin yearned for a manufacturing, rather than a musical career, and, in 1884, he joined with W. T. Russell, then an advertising agent for a New York concern, in purchasing the Ayers firm, incorporating that year the Ayers Manufacturing Company with capital stock of \$5,000, the line of production being limited to five or six kitchen articles that met with a ready sale. Five years later they removed to larger quarters, and eventually took over the Joseph H. Walker shoe shop, which finally was bought by Messrs. Hamblin & Russell, and leased to the corporation. On April 1, 1887, the Hamblin & Russell Manufacturing Company was incorporated, with \$5,000 capital, to succeed the Ayers concern, and in 1918 an increase to \$80,000 was made, while four years later it was fixed at \$200,000, of which amount \$150,000 was fully paid in, with \$50,000 capital stock remaining in the treasury.

The factory is now well equipped with automatic special machines invented and built by the company in its own machine shop, some of which are almost human in their adaptability to the work required. The plant consists of two brick buildings, of mill construction, one five stories high, 160 by 40 feet, and the other three stories high, 200 by 40 feet, thus giving the concern upwards of 150,000 square feet of manufacturing space. The plant is thoroughly equipped with automatic sprinklers, and insurance to the amount of \$500,000 is carried.

The company's 200 page catalog depicts a complete line of hardware specialties and standard wire goods used in the kitchen and by the hardware trade, including tea and coffee strainers, broilers, dish drainers, rotary floursifters, egg beaters, corn poppers, fly traps, kitchen knives, bathroom fixtures, novelties, etc., and a standard line of baseball masks for the sporting goods trade. The company employs from 150 to 200 hands, some of whom have been with it for over thirty years, and it ships its products to all parts of the United States. It maintains resident offices at 44 Warren Street, New York City, under the management of C. S. Messinger, formerly of Worcester. Its sales average about \$500,000 per annum.

From 1887 to 1918 the concern had but three stockholders, but in the latter year it distributed some of its stock to Oscar S. Ryerson, now superintendent of the company, and his brother, Eugene H. Ryerson, assistant superintendent.

During the World War the company did considerable business with the United States Government, executing a number of contracts, all of which were completed and delivered on time.

F. H. Hamblin has been treasurer ever since the original incorporation and W. F. Russell has been president since April 1, 1887.

GEORGE F. BLAKE, INC.

In 1884, the late George F. Blake, Jr., who died in Worcester, January 1, 1929, founded the business known since 1891 as George F. Blake, Jr., & Company and began operations under the firm name of Blake, Boutwell & Co., in a Front Street building, formerly occupied by Messrs. Mason & Lincoln. Four years later a four-story factory was erected by

Mr. Blake, at the junction of Bridge, Mechanic and Foster streets, which has been occupied as the office and main warehouse ever since. Later, he opened an iron mill, in Wareham, and a retail store in Boston, in connection with the Worcester plant.

In 1920 the company leased the old Boston & Albany warehouse on Franklin Street, which has since been used for storage purposes, and three years later it purchased the property at the corner of Summer and Asylum streets and built its warehouse No. 2, which is used exclusively for handling heavy steel. This building is fully equipped with three five-ton thirty-foot cranes operating the entire length of the building. In 1926 the company completed an addition to its warehouse at the corner of Bridge and Mechanic streets, making it possible to carry a complete line of cold finished steel, such as sheet iron, turned and ground shafting and cold drawn bars.

This concern has added to its equipment from time to time until today it is able to do all kinds of high speed cutting and is the only company in the vicinity of Worcester equipped with machines capable of cutting solid steel bars as large as 12 inches by 36 inches.

It also has high speed saws and specializes in cutting and bending reinforcing bars to any specifications.

George F. Blake, Inc., is the agent in Worcester for the Ludlum Steel Company and William Jessop & Sons Company, the Buffalo Foundry & Machine Company, Jones & Laughlin Steel Corporation, and the Goodyear Tire & Rubber Company, and is the Worcester distributor for the United States Chain & Forging Company. C. C. Dodge is the general manager of the plant.

George F. Blake, Jr., was the son of George F. Blake, of Medford, the inventor and manufacturer of the famous Blake pump, and was a graduate of the Massachusetts Institute of Technology.

THE REED & PRINCE MANUFACTURING COMPANY

The Reed & Prince Manufacturing Company is the corporate successor of the partnership firm, formed in April, 1886, by Edgar Reed and Thomas Prince, under the name of Reed & Prince, to engage in the manufacture of rivets, burrs, wood and machine screws, and stove and tire bolts. At that time 7,000 square feet of manufacturing space were used, and five employees were on the payroll.

In 1902 the business was incorporated under its present name, and in July, of the following year, its present extensive factory at Webster Square, where upwards of 700 operatives are now employed, was occupied.

By that time the company was utilizing 165,000 square feet of manufacturing space. The original line of production has been extended and today includes wood and machine screws, stove bolts, cap and set screws, nuts, rivets, burrs, rods and specialties.

Its commodities are marketed throughout the United States and in many foreign countries, and the phenomenal growth attained in recent years under the able management of Edgar Reed, president, and his sons, Alden Reed, who is treasurer, and Chester T. Reed, the secretary of the corporation, provides added evidence that there still exists room in Massachusetts for progressive concerns, whose quality products are at all times kept up to date. The corporation has capital of \$75,000.

A. G. HILDRETH

In 1887 A. G. Hildreth began the manufacture of overalls, pants, suits, and butchers' frocks, in the Stevens Block, employing forty-five hands, and using sixteen sewing machines. That year he cut and made up 325,000 yards of fabrics and in 1888 more than 500,000 yards of goods were required.

Sixty hands are employed in the Hermon Street factory, and only overalls and shirts are now produced. A. G. Hildreth was president and treasurer of the concern, up to his death in April, 1929. The corporation has capital of \$100,000 and Ralph M. Forbes is assistant treasurer.

THE WOODWARD & POWELL PLANER COMPANY

Edward M. Woodward and Albert M. Powell incorporated the Powell Planer Company in 1887 to manufacture iron planers, shapers, and other machinists' tools. In 1899 the capital was increased and the name was changed to the Woodward & Powell Planer Company. During the intervening years the corporation has made a larger variety of sizes and shapes of tools than any other concern in the United States. It controls several important patents on metal planing machines and does a large foreign business, employing about 100 skilled mechanics. The corporation has capital of \$50,000. Edward M. Woodward, Jr., son of the senior founder, is president and treasurer, and W. W. Earl, is secretary of the corporation.

THE BAY STATE STAMPING COMPANY

The Bay State Stamping Company was established in 1888, and manufactures a number of specialties under its own patents, in addition to special stampings, many of its products being exported to England, France and Belgium. It specializes in small and odd-shaped stampings for tool makers, machine tool builders, automobile producers, and inventors. It also manufactures Bennett's self closing oil hole cover, Bennett's horizontal oilers, the Bennett emery wheel dresser, the Bennett turning tool, and the Bennett friction cap grease cup, as well as screw driver ferrules, tapes, and adjustable curtain brackets.

The founder of the concern, John Harrington Bennett began business with capital of \$500 and received many patents on oil and grease cups and a large variety of articles made of sheet metal.

The concern employs upwards of 100 hands, and is capitalized for \$125,000.

D. W. Lincoln is president, E. R. Bennett, secretary, and Celia E. Bennett, treasurer.

In 1888, James C. Green began the production of yarn and today Roy C. Green carries on operations in the Southgate Street plant, and produces cotton warp.

The Wachusett Mills were established in 1888, by Harry W. Smith, and were incorporated in 1894.

THE WACHUSETT THREAD COMPANY

In 1889, Peter Wood, James Montgomery and Charles Dolan, formed the Wachusett Thread Company, and erected a two-story factory, which in 1911 was superseded by a modern structure, thus affording the enter-

prise an opportunity to segregate all operations under one roof. The concern employs 125 operatives in the production of spool cotton, and has capital of \$90,000. James Montgomery is president and treasurer, and E. L. Walker is secretary. The company has its Boston office at 89 Beach Street.

GEORGE L. BROWNELL

George Loomis Brownell, inventor of improved twisting machinery, began business in 1889, with fifteen hands. He now employs upwards of 100 operatives, in the production of twisting machines for producing hard or soft twines, lines and cordage from either cotton, linen, hemp, manila, sisal, paper, jute, hair or wool.

Since 1910 his son, Carl R. Brownell has been associated with him.

When the founder began business in 1889 in one of the buildings now owned by the Wire Goods Division of the Washburn Company, he occupied one floor and the basement. In 1895 he removed to his present location, a factory built in 1882 for The Worcester Barb Fence Company. Here, Mr. Brownell occupied the first floor and basement until 1909, when the increased business warranted his taking the entire structure for production purposes.

P. M. PFAFFMAN

In 1889 Philip M. Pfaffman purchased the satinnet mill owned by Lucien B. Butler, and in the intervening years the plant has been enlarged and production has steadily increased. Fifty operatives are employed in the manufacture of satinets. Joseph T. Daly is superintendent of the concern, which is solely owned by Mr. Pfaffman.

THE STANDARD FOUNDRY COMPANY

The Standard Foundry Company was established in 1889 and incorporated in 1897, with capital of \$40,000. Upwards of 100 men are employed in the production of grey iron castings. Charles F. Hutchins is president and treasurer of the concern.

THE FRANCIS REED COMPANY

One of the oldest concerns engaged in the manufacture of drilling machines, had its origin in 1889, when Francis Reed purchased the George Burnham Company.

Hand-power blacksmith's drills constituted the original product, but these were improved by the application of power to various sizes and types, with consequent improvements in the drills. Machines for drilling railroad rails were next invented and added to the company's products, followed by a line of planer chucks, the manufacture of which was transferred to another concern, in order that the Francis Reed Company might concentrate its activities on drilling machines.

The next development was the invention and production of a complete line of sensitive power-driven drilling machines, which necessitated additional factory space in order to keep up with the orders, and the company erected its own plant, and that year the name of the concern was changed to the Francis Reed Company.

In 1913, the competitive business of the H. G. Barr Company was

purchased, and the two lines of production were merged and are still carried on.

Changes in design and many improvements were effected, and a new type of high-speed ball-bearing drill was invented and built, and within a few years a line of ball-bearing machines, equipped with built-in electric motors, has been developed, the manufacture of which now constitutes the bulk of the company's production.

The factory has a capacity of about one hundred spindles per month, and the company employs thirty-five skilled employees; M. F. and R. S. Reed constitute the present partnership.

THE G. F. WRIGHT STEEL & WIRE COMPANY

In 1862, George F. Wright, a native of Westford, and who, in 1858, was a member of the firm of Burt, Wright & Co., manufacturers of horse-power machinery, in Harvard, entered the employ of the Clinton Wire Cloth Company, of Clinton, where, for twenty years he was superintendent, during which period he patented the first complete fly shuttle loom, designed for weaving wire cloth for fly screens. It was in Clinton, too, that he originated the method of drying painted wire cloth by running it into a tower, and there also that he devised the automatic machinery to carry out the process—a system which eventually came into general use in all plants weaving window screens.

Undoubtedly, he was the first inventor to construct a machine in the United States to weave hexagonal mesh netting, such as the type used in poultry enclosures and fences. Mr. Wright also originated a method of papering boxes, and disposed of his patent to the Dickerman Paper Box Company, of Boston, the principle later being embodied in machinery built by the Hobbs Manufacturing Company, of Worcester.

In 1883, he organized, with his sons, the Palmer Wire Goods Company and established a plant, in Palmer, where wire cloth and lath were made, followed two years later by poultry netting. In 1895 a reorganization under the name of the Wright Wire Cloth Company was effected and in 1889 the name was changed to Wright & Cotton Wire Cloth Company, when Samuel H. Cotton entered the business, and it was removed to Worcester.

In 1902 the concern became the Wright Wire Company and the line of production was extended to wire, wire cloth, window screen cloth, wire rope and cable, wire clothes lines and picture cord, poultry netting, lathing, steel and wire fencing, etc., and at the time of the death of Mr. Wright, in 1903, about 1,000 operatives were employed by the concern.

When the Wickwire-Spencer Steel Corporation was formed the Wright Wire Company was merged in that organization.

But the name of Wright was destined to remain associated with the development of the wire industry of America, in which field it had occupied an enviable place for more than a half century before, for in 1921, George F. Wright, son of the late Hon. George M. Wright, who had honorably served the city of his adoption as its mayor, and grandson of George F. Wright, the master mechanic of the Clinton Wire Cloth Company, established the G. F. Wright Steel & Wire Company.

The growth of this unit in less than a decade has been little short of phenomenal, its products consisting of hexagonal netting, steel wire cloth, straight line netting, steel clothes lines, hardware cloth, and finest tire

guards which are marketed throughout the United States, and in many foreign countries.

Stocks are carried in New York, Philadelphia, Los Angeles, San Francisco, and Chicago.

The company's plant is located in the village of Jamesville, where the wire that it fabricates into its Superior brand products is drawn, and where upwards of 200 operatives, whose average age is thirty-four years, are employed.

This combination embracing as it does the enthusiasm of youth as well as the experience of men of mature years in the wire industry, spells success.

George F. Wright, a representative of the third generation of a family prominently identified with the wire weaving industry of Massachusetts has been president and general manager of the concern since its inception, and H. F. Hildreth is treasurer and secretary.

The corporation has capital of \$700,000.

THE MATTHEWS MANUFACTURING COMPANY

The Matthews Manufacturing Company was founded by Ambrose T. Matthews in 1890, being originally financed by F. E. Reed, who at that time was the largest manufacturer of lathes in this country. With Mr. Matthews' mechanical ability and Mr. Reed's financial assistance, the company was successful from its inception and during a period of forty years it has grown continuously. The founders, who long since died, have been succeeded in the managerial positions by men whom they developed.

A large part of the organization today consists of employees who started with the company. The first press operator employed by it is now foreman of the press department. The first toolmaker is now president of the enterprise, and along with these are many who have zealously served the company from twenty to thirty years. Supplementing the organization of older men are the younger employees who have been trained to carry on the methods of their predecessors.

The company is equipped to manufacture sheet metal stampings of all materials, all shapes and all finishes in sizes from fifteen inches diameter down. It has within its own plant complete facilities to manufacture necessary stamping tools and to produce the parts; to give them such heat treatment as may be specified; to silver, copper, brass, nickel or cadmium plate the parts and to enamel or lacquer and assemble finished pieces.

The corporation has capital of \$50,000 and employs 200 operatives. F. S. Morton is president and G. M. Pomeroy is treasurer.

J. W. GRADY & COMPANY, INC.

James W. Grady, president of J. W. Grady & Co., Inc., early began the manufacture of bicycles, becoming active in that field in the early nineties when the industry was in its prime.

This type of production is still carried on at the High Street plant of the concern, where twenty-five operatives are employed.

J. W. Grady is president, and W. P. Farrell is treasurer and secretary of the corporation.

THE HATCH & BARNES COMPANY

In 1890 Fred W. Barnes founded The Hatch & Barnes Company, of which he is today president and treasurer. Upwards of 100 employees are engaged in the manufacture of builders' finish, which is furnished direct from the plans of architects.

The company has specialized in its chosen field, the factory equipment being such as to enable it to handle large orders on short notice. It carries on wood turning operations, hand sawing, and irregular turnings, and has capital of \$30,000.

THE WORCESTER DUSTING MILL, INC.

The Worcester Dusting Mill, Inc., was established in 1890, but was not incorporated until 1923, with capital of \$10,000. It produces wool waste and garnetted stock and the plant is equipped with three sets of cards, five dusters, and one garnet.

L. M. Pemstein is president, D. E. Pemstein, is treasurer, and Bennett Pemstein is clerk.

THE HOBBS MANUFACTURING COMPANY

In 1891, Clarence W. Hobbs, Richard Snyder, and Harry W. Goddard formed what three years later became the Hobbs Manufacturing Company and began the manufacture of paper box-making machinery. When, in 1903, the old quarters became inadequate, the plant and business of the Witherby, Rugg & Richardson Company was purchased, and enlarged by the erection of a four-story addition, the production of wood-working machinery also being carried on until 1911, when that branch was disposed of by the concern. In 1910 an addition to the plant 50 by 70 feet, five stories high, was made, and since 1904 a line of nut locks, made from wire by special patented machinery, has become an important part of the business. In 1910, an interest was acquired in coin-operated machines for the sale of postage-stamps, tickets, and the like. The concern is capitalized for \$700,000 and employs 125 hands.

Herbert A. Pike is president, L. M. Erskine, secretary, and F. A. Jones, treasurer.

THE INVENTIVE GENIUS OF CHARLES HILL MORGAN

The Morgan Construction Company, not only an anomaly among the manufacturing enterprises of Massachusetts, in that its major activities—the designing and installing of rolling mills—are carried on in a territory where few of its products are installed, serves as a conspicuous example of what may be accomplished in the domestic and foreign fields of a Bay State corporation operating in an unusual type of manufacture.

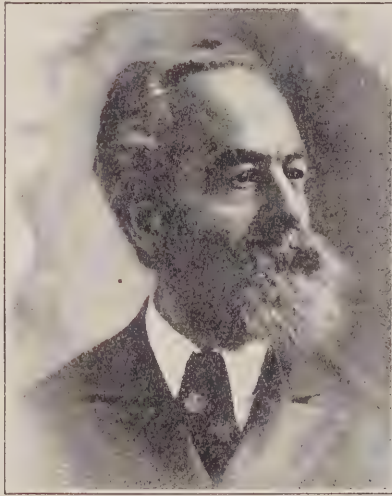
Founded in 1891 by the late Charles Hill Morgan it has become in the intervening years one of the largest corporations in the country specializing in machinery for the hot rolling of certain steel products and the cold drawing of wire, and it is the only concern of its kind located in the East.

Charles Hill Morgan, its first president, also the first president of the Morgan Spring Company, was one of the greatest of the world's inventors and developers of rolling mill and wire drawing machinery.

He was of old New England stock, and at the age of twelve was at

work in a factory. Three years later, he entered the machine shop of his uncle, J. B. Parker, in Clinton, as an apprentice, and when seventeen he determined to learn mechanical drawing. His efforts resulted in the formation of a class for the study of the subject, taught by the late John G. Hoadley, then civil engineer of the Clinton Mills. These few night lessons, after twelve hours of labor in the shop, constituted an all-important factor in Mr. Morgan's early mechanical career.

For five years he served as mechanical draftsman for the distinguished inventor and manufacturer, Erastus B. Bigelow, and this atmosphere of invention exercised a stimulating influence upon his future. During this period Mr. Morgan introduced a system of designing and constructing cam curves for looms which proved of great value. In 1860, with his brother, Francis Henry Morgan, he engaged for two years in the manufacture of paper bags in Philadelphia.



CHARLES HILL MORGAN
Founder of the Morgan Construction Company, Worcester, and one of the greatest of the world's inventors and developers of rolling mill and wire drawing machinery

In 1864, Mr. Morgan became superintendent of manufacturing of Washburn & Moen, and four years later, when a joint stock company was organized, he was made the general superintendent. For eleven years he was a director of the corporation and made frequent trips abroad to visit mills in England, Belgium, Germany, France and Sweden. From these experiences, and from the study of publications devoted to wire manufacturing and of the patents issued, both in Europe and America, he kept himself thoroughly informed of all changes or improvements.

THE FATHER OF THE WORLD FAMOUS MORGAN MILL

Mr. Morgan's life was conspicuously identified with the development of the continuous rolling mill, known the world over as the Morgan mill. The first of the type was designed and constructed by George Bedson, of Manchester, England, one being erected, in 1869 by the Washburn & Moen Company. Experience soon proved that the methods of handling

the product of the mill were inadequate, and the first important step in the development of the process was the power reel invented by Mr. Morgan to replace the old hand operated reel. His second important contribution to the system—which marked the great difference between the Bedson and the Morgan mills, was the practical development of a continuous train of horizontal rolls. The Bedson mill had alternate sets of horizontal and vertical rolls. In the Morgan mill intermediate twist guides were provided, which gave to the metal the necessary quarter turn as it passed between the successive sets of rolls. The design proved so successful that it is the only type of continuous mill in use today. Nine years after the construction of the Bedson mill, a new type was built from Mr. Morgan's designs on the Belgium and continuous plans, and was known as the combination mill. The third improvement was the invention by Mr. Morgan of automatic reels, both of the pouring and the laying types, such as are now in common use in every rod mill in the world. They were completed and the first successful test was made March 10, 1886.

In 1881, he had founded, with his brother, Henry F. Morgan, the Morgan Spring Company, for the manufacture of springs, the concern becoming a pioneer in a line of business now carried on by many corporations.

The continuous rolling of such materials as billets, sheet bars, merchant bar, rods and hoops, together with the disposition of the product after it has been rolled, was given special attention, and a large number of important installations were made in the earlier years of the Morgan Construction Company. The continuous method of heating billets, while not strictly new in itself, was skillfully developed and introduced and culminated in the continuous gravity discharge furnace invented by Mr. Morgan.

THE COMPANY'S WORLD-WIDE FIELD OF DISTRIBUTION

The various units originated by the Morgan concern range in price from a few thousand dollars up to many millions, some requiring two years or more to complete. Nor are its products for the fabrication of billets, steel and merchant bars, hoops, strips and wire rods, and its famous Morgan full automatic gas machines built for America alone, but they have found their way into several European countries, and even to several remote lands, as India and Australia.

Of the total of 157 complete rolling mill plants designed and installed by the company, 119 are located in the United States, and the remaining thirty-eight in France and Great Britain, in each of which countries ten have been placed, with five in Canada, four in Germany, three each in India and Australia, two in Belgium, and one in Austria.

For thirty years the concern has manufactured gas producers, and prior to the time it developed the full automatic type, 630 of its hand operated machines were sold in Europe, as against 654 in the United States, thus indicating that in this field approximately 50% of this type of product went abroad.

During the seventeen months from January, 1927 to June, 1928, the automatic type was marketed in Canada, Mexico, Australia, Great Britain, and India to the extent of eighteen machines, while during the comparable period only ten entered the domestic market. Altogether up to June 1, 1928, 108 machines of the automatic type for making gas for factory use, were sold in Great Britain, forty-four in France, twenty-two in India, ten

in Australia, eight in Canada, five in Mexico, and one each in Belgium and Sweden, a total of 199 as compared with 433 in the United States.

The Morgan Company has executed all of the steel mill designing and construction for the Ford Motor Company, comprising six separate mills, construction upon the last having been started in June, 1928.

The company's business in wire-drawing machinery is heavy in Belgium, and Morgan machinery is to be found in every country in the world where wire is made. Its two Worcester plants have been operating virtually at capacity for half a dozen years past.

THE STORY OF ITS GROWTH

When the company was incorporated, in 1891, it was housed in a few rooms and employed a small force of engineers and machinists. From this modest beginning the operations of the company have expanded until at the plant in Lincoln Square upwards of 139,000 square feet of space is occupied by the engineering department with its 150 men. The administration unit employs 100; the pattern shop has thirty-five pattern-makers and the machine shop employs 350 men. A hospital for physical examinations and treatments of minor injuries by a physician and two graduate nurses in attendance is maintained, and a pattern storage building, with over 9,000 square feet of additional space, a blue-print department which turns out 250,000 blue-prints annually, and a public restaurant, which serves from 450 to 500 meals per day, complete the physical layout of the Lincoln Square plant, while the Crescent Street factory occupies ten acres and is served by 2,500 feet of side tracks of the Boston & Maine Railroad Company. The office building houses a hospital, the telephone central office, the laboratory and the shop drafting room. The erecting and structural shops containing 33,000 square feet of manufacturing space, were built in 1923-24, and in them were incorporated the most recent features of building design, including excellent lighting facilities for both day and night work. Here sixty-five men are employed, while in the heavy machine shop, which houses the gear department equipped with the two largest spiral bevel gear planers in the entire world, 115 men are employed. Two additional plants on Union and Summer streets afford 65,000 additional square feet, for the storage of patterns.

Altogether the working force exceeds 800 men and women and for several years the machine shops have been operated on an 88-hour per week schedule, each shift working 44 hours, the schedule being so arranged as to permit the artisans to secure the greater portion of their sleep during the hours of the night, with ample time available for recreation.

In designing its rolling mills the company's engineers have evolved accessories such as special heating furnaces, flying shears, piling devices, assembling tables, automatic reels, and cooling beds, unique in their functions, all of which have made possible the high tonnages of continuous rolling that have been reached. Millions of tons of steel are rolled on Morgan Mills, every year.

In the Pittsburg, Youngstown, Gary, Birmingham, River Rouge, Chicago, Buffalo, Bethlehem, and other great steel producing centers, are to be found the great billet, merchant, wire rod, roughing, strip, hoop, skelp, flat, blooming, and spring mills installed by this outstanding Worcester concern.

Over 40 per cent of all the millions of tons of steel rods rolled every year in America are made on the Morgan continuous mills; upwards of 44 per cent of all the sheet bar made in this country is turned out on Morgan mills; over 80 per cent of all the small billets fabricated in the United States are produced on Morgan continuous billet wires; over 30 per cent of the merchant mills in this country are of Morgan design and construction, and in the field of skelp products, the Morgan skelp mills turn out over 30 per cent of the total made in the United States.

It certainly cannot be an accident that in a period of fifteen years the Bethlehem Steel Company should have bought thirteen complete rolling mill plants from the Worcester concern, nor that the Jones & McLaughlin Steel Company, in less than a quarter of a century, should have purchased eleven plants, while the Republic Iron & Steel Company should have contracted for ten complete rolling mills. The Youngstown Sheet & Tube Company have purchased nine; the American Steel & Wire Company and the Carnegie Steel Company have installed seven each; the Ford Motor Company and the McKinney Steel Company, six each; three other American steel producing concerns have bought four each; four others, three each, and seven others, two each. Conclusive evidence of the complete satisfaction given by the products of the Morgan concern is obtained in these suggestive repeat orders.

The contribution made to industrial efficiency by the Morgan inventions and engineering developments, is incapable of being expressed in terms of the dollar. Just as efficiency counts in any line of human endeavor, so do efficiency and low costs play a significant part in the rolling of steel products—today America's great basic industry and the barometer of American business.

It is as certain as death and taxes that many of the cheap metal products which enter into the lives of every American man and woman would not have been in existence had it not been for some of the most revolutionary improvements that have been originated by the engineers of the Morgan Construction Company, and which have been applied so generally to the steel rolling industry of the United States, and in many other countries of the world. In 1916, the National Manufacturing Company, a consolidation of a number of local wire-working concerns, was bought by the Morgan Spring Company—a subsidiary of the Morgan Construction Company.

The latter corporation has capital of \$500,000 preferred and \$200,000 common stock. Paul B. Morgan is president, Philip M. Morgan, treasurer, and C. C. Smith, secretary, and they, with R. L. Morgan, V. E. Edwards, Jerome R. George, M. Morgan, and J. W. Sheperdson, constitute the board of directors.

THE OLSON MANUFACTURING COMPANY

In 1892, Carl J. Olson began the building of machinery for the manufacture of screw machine products, in the plant of the McCloud, Crane & Minter Company, in Worcester, and the historian is able to chronicle the fact that it was in that factory that the Olson Manufacturing Company had its inception, although it did not come into being until 1913, when Robert C. Olson, one of the seven sons of Carl J. Olson, founded it with twelve screw machine spindles.

Every one of the senior Olson's boys followed the screw machine trade,

and when the time was ripe for the family to establish a business bearing its name they had acquired an experience that augured well for success.

In 1917 the Olson Manufacturing Company was incorporated, and today the plant is equipped with 125 spindles for work up to 2¼ diameters in steel and brass. The products largely enter into the automotive industry.

Robert C. Olson is president and treasurer, Hugo P. Olson, vice president, and Richard L. Olson, secretary, and they, with O. G. Olson, constitute the board of directors. The corporation has capital of \$50,000 and employs fifty or more operatives.

THE LORING MANUFACTURING COMPANY

In 1892, John W. and Elmer H. Loring formed the firm of J. W. Loring & Son, both having been engaged for years in the city in the manufacture of organs, under the name of the Loring & Blake Organ Company. However, they appreciated the fact that the piano was rapidly superseding the cabinet organ, and specializing in machine wood-turning the new concern twice outgrew its original quarters, and, in 1905, removed to 140 Union Street, where it is located today. In 1907, Elmer H. Loring purchased the property occupied by the firm, and the following year bought his father's interests, and formed the Loring Manufacturing Company which at that period manufactured most of the woodturnings used in piano player actions in the United States.

In 1912 Mr. Loring's son, Dr. Burton E., entered the employ of the firm, giving up the practice of dentistry in which he had been engaged since 1901. At that time the woodturning part of the business was very prosperous, but with the coming of the radio, and the improvement of automobiles, changes in the tastes of the people wrecked the player piano industry and forced a change to novelty turnings, handles and specialties. This made the installation of new machinery necessary and a general change in policy.

The cabinet line was developed and there is a large local business in that line, especially in custom furniture and interior work, and a general line of private telephone accessories.

Since the death of Elmer H. Loring, on January 29, 1927, the business has been carried on by his son, Dr. Burton E., who represents the third generation to be interested in the firm's progress.

Thirty-five hands are employed at the plant.

THE WORCESTER ENVELOPE COMPANY

The Worcester Envelope Company formed, in 1903, is the successor of the Emerson, Lowe & Barber Company, which began business four years before. It employs from seventy-five to one hundred hands, and has capital of \$38,000. John N. Barber is president, George W. Grant, treasurer, and C. H. Lekberg, secretary.

BREWER & COMPANY, INC.

When, in 1893, Edwin Avery Brewer became the sole owner of Bush & Company, a business which had been established in 1852 by William Bush, three men were employed, where today between 400 and 500 are carried on the payrolls. In 1897 Mr. Brewer incorporated the Brewer Company, Inc., and erected the first unit of a modern building for the

manufacture of drugs and proprietary medicines; later adding a second structure and opening and maintaining branches in Boston, Providence, New York, and Fall River. The concern is capitalized today for \$1,000,000 and ranks as one of the largest drug and chemical enterprises in the East.

Howard D. Brewer is president and treasurer, J. R. Owen, comptroller, and Frank C. Smith, is clerk of the corporation.

THE AMERICAN CAR SPRINKLER COMPANY

The American Car Sprinkler Company was established in 1895 by Frank D. Perry, with \$30,000 capital, and today employs from seventy-five to one hundred operatives in street sprinkling and flushing, with cars, the present officers being Frank D. Perry, president; Earl D. Perry, vice president; Edwin H. Davis, treasurer, and Andrew C. Crawford, clerk. The American Roofing Department is a subsidiary unit of the Car Sprinkler Company and specializes in tar and gravel roofs and tar floors and walks.

JOHN J. ADAMS

In 1895, John Julius Adams succeeded A. M. Howe, who had begun the cutting of dies, in Westboro, in 1857, and who removed to Worcester three years later. In 1861, Mr. Howe held a United States government contract to make primers for guns, and later he began the production of boot and shoe, envelope, and harness cutting dies. In 1889 Mr. Howe patented a process whereby he was able to prepare his own stock.

John J. Adams had previously been engaged in the manufacture of shoe machinery, and he carried on the business until his death, in 1918. He erected a new plant in 1914, where the business is now conducted by his son, John Jacob Adams, who employs fifty operatives.

THE BALDWIN CHAIN & MANUFACTURING COMPANY

But a little more than thirty years have passed since the chain drive was applied to the operation of mechanical devices. During these three decades, the advent and growth of the automotive vehicle, the element of power in driving agricultural implements, and the use of the chain drive for every conceivable industrial and commercial purpose, have conspired to focus the attention of the mechanical world upon one concern in the United States, which, in a little more than a quarter of a century, has grown to such a size as to produce 75 per cent of all the chains that enter into American automobile production.

It was in 1896 that the late William H. Gates founded the Baldwin Chain & Manufacturing Company and started operations in a little building, which later was abandoned for a commodious plant. The first item of production was a detachable bicycle chain.

Just how the concern came to be known as The Baldwin Chain & Manufacturing Company is shrouded in doubt, but it is known that prior to 1896 a small machine shop was operated in Worcester by a Mr. Baldwin, and that he received a patent on a type of block chain, which, however, was never used to any extent. Mr. Baldwin consulted Mr. Gates, at that time a practising attorney in Worcester, who advised him on some legal matters, and eventually the latter purchased the business.

But the progress and development of the concern were along lines entirely different from those pursued by Mr. Baldwin, and its growth up

to the time of his death, in 1926, was due to the energies and acumen of Mr. Gates.

He surrounded himself with able executives, William F. Cole, now vice president, and a graduate of the Worcester Polytechnic Institute, identifying himself with the corporation, in 1910, while A. W. Warren, the sales manager, and H. Klaucke, the chief engineer, began their connections with it about 1914. William H. Gates, Jr., entered the business about 1918.

In 1927, the corporation built and occupied its magnificent new plant, with its upwards of two acres of manufacturing space, all on one level. It was in the original factory that the Baldwin unit began the production of block chains, which reached the zenith of their popularity during the height of the bicycle era.

Its wonderful success in the intervening years but attests why it is that Massachusetts still forges ahead in the industrial procession, for its far-seeing executives, discerning that another mode of transportation was to supplant the foot-driven bicycle, early turned their attention to the development of a mechanism that would become an integral part of automotive production, and evolved a successful chain drive which, in addition to being a pioneer in the power transmission field, has become more generally used by automotive engineers than the product of any other manufacturer.

While the automobile industry was still in its infancy, the Baldwin engineers, ever alert for new methods and materials that would maintain the early established reputation for quality products in its original field, became interested in the roller chains which had been developed in England and on the Continent.

After years of studies and tests they developed, in 1900, just at the birth of this century, the first roller chain ever manufactured in America.

The invention was indeed opportune, and it is not an over statement to assert that had the engineers of the Baldwin concern delayed a few years in perfecting their processes Stanley, Packard, Haynes, Olds, Duryea, and other pioneer American automobile designers and manufacturers would not have been able to produce their first cars at so early a period as they did.

The Baldwin unit shared with these entrepreneurs in pioneering in the automotive field. The original Packard motor car and the first Olds machine were equipped with Baldwin chain drives, and when the Messrs. Stanley built their first steam car, in 1897, it was turned out with the Baldwin block chain drive.

Since these early days the use and application of the chain drive has been extended greatly. With the coming of the tractor, the chain has been widely adopted as a final drive. The first tractor marketed by the International Harvester Company was equipped with a Baldwin chain drive. Its extensive use on farm implements in the place of cast or malleable iron chains is daily becoming more evident. In the industrial field, its use as a drive from shaft to shaft on machines or from prime mover to machines is firmly established, and as a conveyor of materials in industry of every description its use is daily increasing in scope and magnitude.

In June, 1927, Frank J. Weschler, who had been a principal executive of the Indian Motorcycle Company, of Springfield, for many years, was

elected president and treasurer, and under his management the company has enjoyed the largest volume of business in its history.

William F. Cole and Henry Blumenauer are vice presidents, and William H. Gates, Jr., is the production engineer of the corporation, which employs upwards of 250 operatives, and has capital of \$750,000.

In the field of chassis and sprockets for power transmission and conveying this Worcester concern stands supreme.

THE SHERMAN ENVELOPE COMPANY

The Sherman Envelope Company was organized in 1899 by John A. Sherman, who built seven envelope machines of his own invention, with which he began operations, later adding thirteen more of the same pattern. The company was incorporated February 1, 1900. Five years after the concern started Mr. Sherman erected a brick factory. The original capital of the corporation was \$65,000, which has since been increased to \$500,000.

Mr. Sherman's initial machines produced 90,000 envelopes a day, as against 37,000 per day on other machines, then in universal use, and his invention was immediately taken advantage of by large envelope producers, the Mercantile Manufacturing Company, of Dayton, Ohio, which long held the contract for printing stamped envelopes for the United States Government, installing forty-seven of the Sherman machines.

Mr. Sherman was one of the pioneers in the production of oil burners, inventing a machine of that type controlled by a thermostat.

C. St. Thomas is president, Burton K. Fiske, is secretary, and J. A. Galvin is treasurer of the Sherman Envelope Company, which employs upwards of 200 operatives in the production of envelopes and drinking cups.

In 1898 the Allen-Higgins Wall Paper Company was started in Worcester, and is now the Allen-Higgins unit of The Prager Company, Inc., of New York City. It employs 125 hands at the local plant.

THE STOCKBRIDGE MACHINE COMPANY

Radford Stockbridge founded the Stockbridge Machine Company in 1899, designing a speed lathe which found a ready market, but which he neglected to patent, with the result that it was appropriated by another manufacturer. Later he invented the Stockbridge two-piece crank shaper, which met with such success as to make it imperative to secure larger quarters, in order to produce the machine in quantity sufficient to cope with the demand.

Among other devices invented by Mr. Stockbridge were a machine for cutting gimlet-pointed screws on wire goods; an automatic eye-machine, for making screw-eyes, this invention having a capacity of ninety a minute; a new style of planer, and a device for a driver on a lathe. In 1928 the company redesigned its shaper, which placed it abreast of anything on the world market.

The concern employs between seventy-five and one hundred operatives. John W. Harrington is president and treasurer of the corporation.

OTHER LOCAL ENTERPRISES ESTABLISHED IN 1899

In 1899, Theodore Parker Brown organized the Simplex Player Action Company, one of the first concerns to turn out a practical player piano,

the business having developed from that of an outside or cabinet player to mechanism installed within a piano case, and known to the trade as a "player-piano" in distinction from the "piano player."

To Mr. Brown is accorded the credit of the invention of the player-piano, and it appeared at a time when these devices were novel and unusual. In 1905 the business was incorporated, with capital of \$125,000, since increased to \$250,000, and upwards of 350 employees are now on the payrolls.

Theodore P. Brown is president and treasurer, and R. W. Olmsted is treasurer.

The Whitney Manufacturing Company was established in 1899 to manufacture fine stationery, and the original ten employees have grown to 100 at the present day. The concern is owned by Edward C. and Harry S. Whitney.

THE CRANSKA THREAD COMPANY

For half a century the Cranska interests have been centered in the manufacture of cotton yarns and thread. Since 1917, Lucius B. Cranska has managed both the Worcester and Moosup, Conn., plants of the Cranska Thread Company, in which 250 hands are employed.

Three floors are given over at Worcester to the dyeing, glazing and winding operations, and the spinning is carried on in the Moosup mill. The founder of the concern, Floyd Cranska, spent his entire life in the production of cotton thread yarns in white, black and colors for the manufacturing trade, and many well-known makes of shoes, slippers, clothing, shirts, and other garments are stitched with Cranska thread. The Worcester plant turns out 5,000 dozen spools of cotton daily.

Lucius B. Cranska is president and treasurer of the corporation, which has capital of \$100,000. Thomas J. Seaton is vice president, Edwin G. Norman, secretary, and E. E. Higgins is superintendent of the Worcester plant.

OTHER INDUSTRIAL CONCERNS OF THE NINETIES

Among other units that were prominent in the industrial affairs of Worcester during the closing decades of the last century were the Winslow & Curtis Machine Screw Company, George Burnham & Company, Albert H. Steele, E. J. Somers, F. A. Atherton, R. E. Kidder, Mason & Risch, C. W. Humphrey, Henry E. Dean & Company, the American Awl Company, Fowler & Company, J. C. Spiers & Company, Luther Shaw & Son, E. O. Knight, W. C. Young & Company, the Clark Moulding Works, H. H. Mason, G. W. Ingalls & Company, Jos. A. Sawyer & Son, Worcester Steam Boiler Works, Newton Darling, Ezra Sawyer, P. E. Somers, the Worcester Fire Appliance Company, McCloud, Crane & Minter, the Ames Plow Company, L. Hardy & Company, William S. Hagar, and W. F. Burgess & Company.

THE LELAND-GIFFORD COMPANY

In 1900, William H. Leland and Albert J. Gifford established the Leland-Gifford Company, and began the production of machine tools in a small barn in the rear of the latter's home, containing 500 square feet of manufacturing space, and employed two men and a boy, the founders working days, nights and Sundays in perfecting a screw machine.

In less than three decades the concern has grown until it now occupies several modern structures of brick mill construction, containing 121,600 square feet of floor space, and it employs upwards of 300 highly skilled mechanics. Its operations are now divided into two distinct fields—the Crankshaft Division, which manufactures, finishes and markets the highest type of marine, automobile and aeronautical crankshafts, and the Machine Division, engaged in the production of ball-bearing sensitive drilling machines, profilers, and direct motor driven way type drilling and tapping machines.

Three years after it began business it removed to a one-story factory, containing 4,000 square feet, where a jobbing business was carried on by the partners. In 1904, Subbo Nikoloff, a skillful machinist and inventor, was admitted to the firm, and the Leland-Gifford Company was incorporated.

While grinding some crankshafts for a Detroit concern, Mr. Leland seized what he believed to be an opening for future business, and, with Mr. Gifford, he set to work to build a machine for grinding crankshafts and abandoned the screw machine. In 1903 a crank-pin grinding machine was perfected by the partners—the first in this country, and from that year the success of the concern was assured.

In 1906 the company erected a brick plant, which increased the manufacturing area to 12,500 square feet. In 1910 it built another brick unit, three stories high in one section, and two stories high in the other, which provided 24,000 square feet of floor space. Three years later a brick plant was erected on the opposite side of the street, two stories high, with a monitor roof, which addition gave the company 50,200 more square feet of manufacturing area. In 1917 this building was greatly enlarged by the erection of another wing, which provided 89,300 square feet, and in 1923, this unit was raised to a four-story structure, and with minor additions made from year to year, the company now has 121,100 square feet of manufacturing space. The corporation employs 250 operatives.

It maintains branch offices for sales and service in New York, Chicago, Detroit, Rochester, and Boston, and the corporation has capital of \$500,000. W. H. Leland is president, A. J. Gifford, treasurer and secretary, and S. Nikoloff, vice president.

The Leland-Gifford Company furnishes added evidence that the city of Worcester is still forging ahead in the field of quality machine tool production, and an interesting feature of its present-day business is the grinding of crankshafts for airplanes, most of those used in American planes being finished in the Worcester plant, ready for installation.

THE QUEENSBURY MILLS

The Queensbury Mills were established in 1900, but were not incorporated until twenty-four years later, with capital of \$365,000. They produce mohair and worsted yarns and the plant is equipped with 18,400 worsted and 7,000 twist spindles, five worsted cards, ten worsted combs, and two boilers, and the concern employs upwards of 500 operatives.

In 1927 the Queensbury Mills sold their yarn plant, established some forty years previous, in Somersworth, N. H., and one of the few worsted and mohair yarn mills in this country, and concentrated all operations in Worcester.



BARN IN WHICH THE LELAND-GIFFORD.
COMPANY BEGAN BUSINESS IN 1900



PRESENT PLANT OF THE LELAND-GIFFORD COMPANY, WORCESTER

Francis H. Dewey is president, and Frank Kilmer, treasurer and secretary.

THE EASTERN BRIDGE & STRUCTURAL COMPANY

From the fabrication of 300 tons of steel a month to a capacity of 1,500 tons each month, is the story of the growth of the Eastern Bridge & Structural Company, which was incorporated in 1900, and began operations in March, of that year, with capital of \$75,000, largely subscribed by Worcester investors.

The founders were Ralph H. Brown and A. S. Miller, Jr., who were formerly connected with the Boston Bridge Works.

The company began its operations in the old car-barn, formerly owned by the Worcester Excursion Car Company, on Crescent Street, and about one and one-half acres of land were used for storage and other purposes, while 9,000 square feet of manufacturing floor space, and the services of fifty men, were required.

During the intervening years, adjoining realty has been purchased, until today the company owns nine acres of land, and utilizes 60,000 square feet of factory area, and employs 200 men.

There has never been any increase in the company's capital stock, and the growth in land and buildings has been financed solely from its earnings.

In addition to fabricating structural steel for buildings and bridges, it also manufactures ornamental iron, including fire escapes, railings, stories, and the like.

John C. Stewart is president, A. S. Miller, Jr., treasurer, and Charles T. Tatman, Esq., clerk.

THE M. D. HOLMES & SONS COMPANY

On April 1, 1900, Martin D. Holmes founded the business of M. D. Holmes & Sons, which was incorporated in 1909 as the M. D. Holmes & Sons Company, and which has been engaged in metal work, heating and plumbing since its inception.

It employs thirty-five operatives. F. E. Holmes is president, E. R. Holmes, secretary, and E. H. Holmes, treasurer of the corporation.

THE PARKER WIRE GOODS COMPANY

The Parker Wire Goods Company was formed by Arthur H. Parker, in 1901, beginning operations with a force of three men, which has grown to 200 today. Specialties in wire, wire hardware, special wire forms, metal stampings and metal athletic accessories, constitute the principal products of the concern, which are marketed throughout the United States and Canada, Mexico, South America, Hawaii, Porto Rico, and other foreign countries. The original company was known as the Parker Metal Goods Company and had capital of \$50,000.

In 1923 the company erected and occupied what is considered the finest plant in the country devoted to wire working. Its present facilities for the manufacture of wire hardware and special wire forms for manufacturing consumers is unexcelled.

The personnel of the organization embodies many highly skilled workers who for years have been especially trained to produce accurate and

intricate wire forms, and the capacity of its tool makers and designers is of a very high order. The company has rendered signal service to a great number of manufacturing consumers by the re-developing of expensive castings and stampings into economical wire forms which serve their purposes equally well, at a greatly reduced cost.

In 1927, the corporation acquired by purchase the Stephen Richard Company, Inc., of Southridge, and continues to operate the plant in the latter town, although headquarters for sales and shipments are located in the Worcester office of the Parker Wire Goods Company.

In 1928, the buildings and equipment at the Worcester plant were increased approximately ten per cent, and new lines were added to the products.

The corporation has capital of \$84,900. E. D. Priest is president, and Howard W. Nestor is vice president and treasurer.

BROWN'S BEACH JACKET COMPANY

In 1901 the late William W. Brown began the manufacture of beach jackets, in Hartford, Conn., removing the business to his native city of Worcester the following year, where by dint of hard work and close application to business he was able to substantially increase production and sales year by year until it was deemed expedient to incorporate the enterprise in 1921 as Brown's Beach Jacket Company.

Upon the death of Mr. Brown, on March 29, 1929, his son, Samuel W. Brown, became president and treasurer of the corporation, which is the sole owner of all the machinery, patents, rights and trademarks for the manufacture of Brown's beach jackets.

The concern has capital of \$125,000 and employs fifty operatives.

THE ECONOMIC MACHINERY COMPANY

Another twentieth century local industry that has developed by leaps and bounds is the Economic Machinery Company, capitalized for \$350,000, and employing seventy-five hands, in the manufacture of labeling machinery, in its Grafton Street factory. Established in 1901, the first machines were operated by foot power; then followed a simple power machine, and next one that placed body and neck labels on the same package in one operation. Later, special machines that placed a label around the entire surface of a bottle, and then one that labeled bottles with flat surfaces, were evolved, until ultimately the scope was enlarged so that there is no variety of glass package that is not cared for by automatic power machines invented and produced by the company, which does a large foreign business, in addition to thoroughly covering the domestic field.

Arthur F. Blanchard is president, Arvid P. Ekvall and Leonard W. Howell, vice presidents, and Eugene A. Sisson, treasurer.

ARMOUR'S PATTERN SHOP COMPANY

John W. Armour began the manufacture of wood and metal patterns for castings in 1902, and nine years later incorporated Armour's Pattern Shop Company.

John W. Armour is president and treasurer, William W. Armour is vice president, and Mrs. J. W. Armour, is secretary.

THE WORCESTER LOOM WORKS

In 1902, Clinton Alvord, a graduate of Worcester Polytechnic Institute, began the manufacture of pile-carpet looms and textile machinery, incorporating the business in 1904 as the Worcester Loom Company, and in 1916, as the Worcester Loom Works. He invented and patented improvements on the drums for printing the pile yarns for tapestry and velvet carpets, and also brought into practical use the wide Jacquard Axminster loom, which he built, nine, twelve and fifteen feet in width.

The corporation has capital of \$50,000 and employs sixty operatives. Clinton Alvord is president and treasurer of the concern.

THE HEALD MACHINE COMPANY

In 1903, James N. Heald organized the Heald Machine Company, and moved the business established in Barre, in 1830, by his grandfather, Stephen Heald, and continued by his father, Leander S. Heald, to Worcester, where the line of grinding machinery was increased by the addition of the ring and surface grinder, designed especially for grinding piston rings for automobiles and gas engines, and for discs, dies, thrust collars, and the like.

Here is another instance of an astute observer seizing an opportunity to meet what at the period was but a mild demand, but which soon grew into one of nation-wide proportions. The success of the company in this field, led Mr. Heald to design a machine for grinding gas engine cylinders, a problem which proved to be exceedingly difficult, and one that involved a vast amount of study, research, and experimental work. Mr. Heald's invention was almost instantly adopted as the standard machine by practically all of the leading automobile and gas engine manufacturers, and today it is preeminent in its field.

Then followed the internal grinding machine which can be rotated to advantage in grinding either straight or taper holes in the more common classes of work. This invention marked a great advance in the art of internal grinding, and its rapidity, accuracy and efficient operation immediately commended it to the mechanical world.

In 1903, the company contented itself with a shop 100 by 90 feet, but additions, which began in 1907, have followed in rapid succession until the original factory is now 520 feet long by 190 feet wide, four-fifths of which has saw-tooth roof construction, and the force of twenty-two men of the earlier period has been increased to between 600 and 700—evidence that scarcely indicates a serious decline in the operations of this enterprising concern, which has capital of \$450,000. In 1929 another large addition was erected.

John W. Harrington is president, and James N. Heald, is treasurer, these two officials, with Roger N. and Richard A. Heald, sons of the founder, and Paul B. Morgan, constituting the board of directors.

THE IVY CORSET COMPANY

The Ivy Corset Company was founded and incorporated in 1904, and began operations on the top floor of the building at 154 Front Street.

Henry H. Hayes was chosen president, and Mary H. Bowne, treasurer, and the original capital was fixed at \$20,000, all of which was paid in on

November 9, 1906. The controlling interest in the enterprise was acquired by Mary H. Bowne, who became president and treasurer of the corporation. Four years later the company moved to its present building at 40 Jackson Street, which was erected for it, and which the corporation purchased December 3, 1923.

Approximately 28,734 square feet of manufacturing space is utilized, and the company's present capitalization is \$60,000.

Mary H. Bowne is president and treasurer, and A. J. Koob is secretary.

THE LINEHAN CORSET COMPANY

The Linehan-Conover Company was the predecessor of the Linehan Corset Company, which was established by John J. Linehan, in 1904. The company removed to its present large plant of modern construction and especially designed for its growing needs, in 1917.

The corporation has capital of \$75,000, and employs upwards of 150 operatives in the production of corsets. It has a Boston sales office at 501 Washington Street. John J. Linehan is president and treasurer.

THE BOSTON PRESSED METAL COMPANY

The Boston Pressed Metal Company was established in 1905, since which time it has specialized in the production of seamless drawn parts of medium and small sizes from steel, brass, copper, aluminum, zinc, etc., and has devoted particular attention to redevelopment into pressed metal from gray iron, brass and malleable iron castings, die castings, forgings and screw machine parts.

The concern has carried on much research and experimental work, especially in connection with redevelopment, and with remarkable results in eliminating brittleness, reducing weight 60 per cent, increasing strength, eliminating drilling and tapping, reducing costs, improving the appearance and providing cheaper and better finish to metals.

Since the death of Douglas P. Cook, his brother, Roland M. Cook, has served as president of the company, and V. D. Grabell is vice president, and William Sanger is secretary and treasurer.

The corporation has capital of \$100,000, and employs upwards of 100 operatives.

THE WORCESTER BRUSH & SCRAPER COMPANY

The Worcester Brush & Scraper Company was the corporate successor of the old Criss-Cross Tube Cleaner, invented by Eugene J. McCarthy, of Clinton, the patent rights having been bought by Hon. Edward F. Fletcher, formerly mayor of Worcester, about twenty-five years ago. He materially improved upon them until a device for cleaning boiler tubes and gun barrels was evolved, which met with a large sale.

Mr. Fletcher was president, E. C. Gilbert, vice president and secretary, and Edgar E. Sampson, treasurer and general manager of the corporation, up to the time of its merger with the Mason Brush Works, in 1929. The new corporation is known as the Mason-Worcester Company. Sidney R. Mason is president, Edgar E. Sampson, vice president, Edward C. Buell, treasurer and Robert L. Mason, secretary.

THE LOMBARD MACHINE COMPANY

The Lombard Machine Company founded in 1840, is another Massachusetts manufacturing unit that has been rejuvenated as the result of a twentieth century invention by a Worcester man. In 1905, James J. Rae, a practical carder, made a contribution to the textile world in the form of an important improvement in woolen cards, which was designed to materially increase the capacity of a card, tests of it proving beyond dispute that enhanced production and efficiency resulted from the use of the "Rae system." In 1913 the Lombard unit began the manufacture of the invention, known as the Lombard New Century Card, in addition to producing many forms of carding and textile mill machines, appliances and attachments. The market for these devices not only extends throughout the United States but to Canada, South America, and Japan.

The corporation has capital of \$125,000 and employs approximately 100 operatives.

James J. Rae is president and treasurer and M. E. O'Donnell, is assistant treasurer and secretary.

THE ROCKWOOD SPRINKLER COMPANY

In 1906, George I. Rockwood founded the Rockwood Sprinkler Company to manufacture automatic sprinklers invented and patented by him, and established a business which has grown by leaps and bounds within the period of less than a quarter of a century.

Capitalized for \$950,000 the concern employs 300 hands and in addition to producing automatic sprinkler systems which are installed in buildings all over the world, and which are regarded by insurance underwriters as the peer of any on the market, the company produces the Rockwood automatic dry pipe valve, the Rockwood variable pressure alarm valve, the Rockwood and Carlson beam clamps and pipe hangers, the Carlson concrete hanger blocks, pipers bench vises, expansion drilling and tapping machines, special pipe bending work, and special pressed metal work, as well as Rockwood bronze seat pressed steel pipe unions.

Mr. Rockwood is president and treasurer, J. P. Ashe, H. W. Park, and Harold Ashe are vice presidents and Paul S. Smith, is secretary of the corporation. A branch factory is operated in Chicago, and offices are maintained in many of the leading cities of this country, as well as in Canada, Europe and Asia.

The concern has filled many important contracts for the United States government for metal articles, the processes of making which were devised by Mr. Rockwood.

The Rockwood sprinkler early received the hearty endorsement of the National Board of Fire Underwriters, and later of the Association of Factory Mutual Fire Insurance Companies, and of the Improved Risk Mutual group. The company expended \$100,000 for machinery and tools and \$150,000 in real estate during its earlier years, and its total assets today are considerably more than \$500,000. The Worcester plant occupies an area of six acres of land, which is served by a Boston & Maine Railroad spur track.

Nine of the principal executives of the corporation are graduates of Worcester Polytechnic Institute, a fact which indicates that the founder

is keenly interested in gathering about him a corps of scientifically trained men who will keep the concern in the forefront in the future as it has been in the past. Recent inventions of Hjalmar J. Carlson have added to the prestige of the corporation in its chosen field.

STEVENS-WALDEN-WORCESTER, INC.

F. E. Walden, the inventor and patentee of a wire handle ratchet wrench, little dreamed when he formed the Walden Manufacturing Company, in 1906, that in less than a quarter of a century its corporate successor,—Stevens-Walden-Worcester, Inc.,—would employ upwards of 200 hands, and that the wire handle ratchet wrench would not represent more than two per cent of the company's production.

In 1907, Warren S. Bellows purchased the Walden Manufacturing Company and seven years later the name of the concern was changed to Walden-Worcester, Inc. In 1926, the company was consolidated with Stevens & Co., of New York, a concern of about the same age as the Worcester unit, which originally handled a large line of bicycle supplies and which later entered the automotive field in the production of cotter pins and lock washers, developing in the last dozen years a complete line of special tools for the old model Ford car, and still more recently, a number of garage tools of universal application to all cars, and known as the Stevens speed up devices. The addition of this line to the Walden-Worcester Socket wrench line enabled the merged organization, now known as Stevens-Walden-Worcester, Inc., to produce the most comprehensive line of automotive garage tools in the United States.

It is interesting to note that in less than fourteen years the company's production of wrenches grew from 5,000 a year to 4,500,000 per annum. In 1919, the Worcester concern was carrying on operations in fifteen small buildings, and the following year a modern daylight factory, 330 feet long, four stories high, containing approximately two and a half acres of floor space, with a one story addition in the rear, was erected.

In addition to supplying the garages of America, Europe, Australia and South America with its complete line of tools, the company manufactures a special line of socket wrenches for industrial assembly, which is used on the assembly lines of practically every American automobile manufacturer. It is said that in the Argentine, the Walden-Worcester Wrench has become so well known that it is commonly referred to as a "Walden," rather than as a wrench. Louis Schwab, formerly president of Stevens & Co., is president and J. Vernon Critchley, is chairman of the board. The corporation has capital of \$576,000.

THE AMERICAN NARROW FABRIC COMPANY

The American Narrow Fabric Company was organized in 1906 with capital of \$25,000, and with George H. Vars as president and C. J. Hazelton as vice president.

In 1912 a reorganization was effected and Mr. Hazelton became president.

The concern has had a steady growth, and in 1928 did a business amounting to \$1,230,000.

Its main product is sold under the trade-mark "Gripmor," the coined name of a new hose supporter button which the company patented in 1924.

It manufactures a general line of hose supporters and practically all kinds of sanitary goods, and employs about two hundred and fifty operatives.

C. J. Hazelton is president and treasurer, and the corporation now has capital of \$136,000.

THE NEW ENGLAND ENVELOPE COMPANY

On December 8, 1906, the New England Envelope Company was founded by Frank L. MacNeill, with \$35,000 capital, which was increased to \$60,000 in 1908. It now employs 100 hands in the production of envelopes and paper boxes, making a specialty of window cut, commercial clasp and catalog envelopes.

Frank L. MacNeill is president, George F. Brooks, vice president, and Charles I. Newton, treasurer and secretary.

B. G. LUTHER COMPANY, INC.

In 1907 B. G. Luther and Arthur L. Walls organized B. G. Luther Company, Inc., to manufacture box-making and wood-working machinery.

The concern has capital of \$20,000. L. M. Ludden is president and treasurer, and W. G. Ludden, is secretary.

THE O. S. WALKER COMPANY, INC.

The basic patent covering the Walker magnetic chuck was issued to Oakley S. Walker in 1896, being the outcome of his efforts to produce a practical magnetic brakeshoe for trolley cars.

This application of magnetism opened up a virgin field and O. S. Walker & Co., was organized to exploit Mr. Walker's discovery. Additional patents were issued as time went on and a very considerable business developed.

Meanwhile, Mr. Walker, who had been in the employ of the Norton Company and who already held several patents on grinding machinery, was still active along these lines, and with the magnetic chuck development well under way, he organized the Walker Grinder Company to build the line of cutter and tool grinders and surface grinders covered by these and later patents.

Both of these companies operated under his management, and he contributed much to the fundamental principles on which the art of grinding is founded.

In 1910 the present modern factory was built in Greendale where the two companies continued to operate separately under the same roof until 1915, when they were consolidated as the O. S. Walker Company.

In 1919 new interests acquired the assets of the concern and organized O. S. Walker, Co., Inc., with a capitalization of \$275,000.

The corporation has facilities for seventy-five employees, and manufactures a complete line of rectangular, swivelling, vertical face and rotary magnetic chucks, about fifty sizes and styles being carried in stock for use on planers, shapers, lathes, chucking machines, face grinders and surface grinders.

The corporation also builds a vertical spindle surface grinding machine, which is generally recognized as a device of the highest merit.

The officers are: Wm. B. McSkimmon, president; J. Henry Drury, vice president; Clayton O. Smith, secretary, treasurer and general manager.

THE M. S. WRIGHT COMPANY

In less than a quarter of a century a concern, which did not exist in 1908, has grown until today it is the largest enterprise devoted exclusively to the manufacture of vacuum cleaners in the world.

Morris Sheldon Wright, its founder, has long occupied a prominent position among the great inventors of the present century. In the nineties his attention was directed to improvements in the construction of organs and other musical instruments, and he received fourteen patents on devices, including one on metal piano players, and became the pioneer manufacturer of that type, in 1893.

The same year he designed and invented a player controlled by perforated player sheets, and perfected his system of pneumatic operation of musical instruments, on which he was awarded a number of patents, which were taken over by the Farrand Company, of Detroit, Mich. He also constructed the Aeolian orchestrelle, designed to imitate a full orchestra, and in the spring of 1906 he began another series of experiments in connection with the hardware entering into piano players, and was granted several patents on these devices. That year he engaged in the manufacture of player pianos, he and his son, Henry H., constituting the working force at the outset, but soon afterwards forty hands found employment.

It was in 1908 that he completed his invention of the vacuum cleaner and the following year the M. S. Wright Company was incorporated, occupying 28,000 square feet of space in the first few months of operation, which total was doubled before the end of the year. The total sales in 1908 were \$13,000 but before ten years had elapsed they had grown to \$1,000,000.

Two hundred hands are constantly employed at the company's plant.

In 1914 the company began the manufacture of metal piano player actions and automatic pipe organ actions under the patents granted to Morris S. Wright, but today production is confined exclusively to vacuum cleaners.

Among Mr. Wright's other valuable contributions to the inventive world are organ-stop action devices, one for teaching music on keyed instruments; a reed organ and reed board; a pneumatic piano-player; pneumatic actions for organs; a tone-sheet regulating device; a machine for making a pneumatic diaphragm; an enclosing case for automatic music rolls; a primary action for piano-players; a pneumatic action for musical instruments; metal pneumatic actions for pianos; and an improved metal pneumatic action for musical instruments, all of these being protected by patents in foreign countries, as well as in the United States.

THE WORCESTER PAPER BOX COMPANY

In 1908 Harry Posner began the manufacture of paper boxes, and in the intervening years has built up the business of the Worcester Paper Box Company until, today, 150 operatives are employed. The demands of one customer alone require 2,000 tons of paper and 30,000 pounds of colored inks annually, for the manufacture of 60,000,000 boxes used by it each year. The company is capitalized for \$200,000, and Harry Posner is its president and F. N. Applebaugh is treasurer.

THE HOLMES ELECTROTYPE FOUNDRY

The Holmes Electrotpe Foundry was established by Hon. Pehr G. Holmes in 1909, and from a force of three men has grown to employ more than a score, while its customers are located throughout New England. Mr. Holmes is the sole proprietor of the business.

THE NEW ENGLAND CORSET COMPANY

The New England Corset Company was established in 1906 under the name of the Maynard Corset Company, and three years later it was purchased by J. Howard Jaynes, Wallace C. Spinney and Frank C. Smith, Jr. During the World War the concern produced haversacks and hospital supplies for the government. In 1917 it was reorganized and now occupies more than 30,000 square feet of manufacturing space.

It has capital of \$150,000, and employs upwards of 200 operatives, in the production of corsets and brassieres.

Oscar L. Weingarten is president, Edward N. Clark, secretary, and I. R. Smith, treasurer.

THE P. W. WOOD LUMBER CORPORATION

The P. W. Wood Lumber Corporation is another of Worcester's twentieth century concerns, having been started in 1909 by Plinn W. Wood. By 1925 its sales had reached nearly \$1,000,000 a year.

Upon the death of the founder, in 1926, the business was taken over by P. W. Wood, Jr., A. W. Wood, and L. P. Greenleaf.

The corporation has capital of \$125,000 and employs twenty-five hands. P. W. Wood is president and treasurer, A. Wayland Wood, is secretary, and they, with L. R. Greenleaf, and P. W. Wood, Jr., constitute the board of directors.

THE COPPUS ENGINEERING CORPORATION

Some of the more recent outstanding local inventions have emanated from the brain of one of the adopted citizens of Worcester—Frans H. C. Coppus, a native of Holland, where he secured a technical education, which was followed by practical experience in loom works, in Germany. In 1902, he came to America, intending to stay only a year, but the lure of the United States urged him to remain and become a citizen of this country. For a time he was employed as a draughtsman by the Crompton & Knowles Loom Works, and by the Draper Corporation, of Hopedale, and at the former plant he conceived the idea of applying an automatic shuttle plenishing device to box looms, which patent he sold to the Crompton & Knowles concern, and re-entered its employ.

With a yearning to apply himself to steam engineering he went West, and entered the employ of the Waukegan, Ill., plant of the American Steel & Wire Company. In 1908, he decided upon a long vacation in Holland, and desiring to husband his time while in his native country, he became identified with a New York concern, then engaged in marketing a smoke-consuming apparatus. It was during this period that he became keenly interested in fuel saving and smoke consuming devices, and he made a thorough study of the combustion field. At the end of eight months he returned to Worcester, where, for a time, he was employed by the Morgan Construction Company, but, in 1909, he opened an office as

a combustion engineer. Two years later, he invented the Coppus Turbo Blower, for forced draught, and, in 1912, formed the Coppus Engineering & Equipment Company to manufacture the product, becoming president, treasurer and general manager of the concern. The original plants on School and Union streets were modest affairs, but in the spring of 1917, the factory formerly occupied by the Hill Clothes Dryer Company was purchased, consisting of two four-story brick buildings, and containing about 30,000 square feet of space. Later, the plant was reconstructed throughout, and an addition was built for a brass foundry.

In 1917 the company began the manufacture of centrifugal pumps and engaged Otto Wechsberg, an experienced centrifugal pump engineer, to supervise this type of production.

Two years later, a new modern brass foundry was erected, and as it afforded sufficient facilities to engage in jobbing work, a separate corporation was formed, under the name of the New England Brass Foundry Company. In 1922 the Coppus Engineering & Equipment Company and the New England Brass Foundry Company were merged into one unit—the Coppus Engineering Corporation.

Readjustment from wartime conditions was necessary and the company began to look for larger fields. The Coppus Vano Blower was placed on the market, this device possessing characteristics different from any other blower. It met with a ready market where high capacity was desired in limited space such as mine ventilation, and the company enjoys an enviable business in both the domestic and foreign fields in this line, its blowers for mine ventilation being shipped to every nook and corner of the globe. Another application of this blower is for re-circulating flue gases in oil distilleries handling gases of temperatures up to 1,200 degrees.

A new field of activity was seized by building blowers and pumps for locomotives. After many years of experimentation, a blower was developed to draft locomotives in roundhouses, and also a centrifugal boiler feed pump and locomotive feed water heater. This business requiring undivided attention, Mr. Coppus, in 1926, acquired the exclusive interest in the locomotive business and founded the Coppus Locomotive Equipment Company, remaining as chairman of the board of the Coppus Engineering Corporation.

Otto Wechsberg succeeded him as president of the latter concern, which is capitalized for \$250,000, and employs 150 operatives. Jerome R. George, Jr., is treasurer.

THE HILL CLOTHES DRYER COMPANY

The invention of the Hill clothes dryer solved a perplexing problem for the American housewife, and like many products of universal use the device was simple in design and in construction.

Back in the early stages of man's development, the limited clothing equipment of human kind was hung upon small trees to dry, and taking advantage of this precedent, the Hill dryer supplied an artificial tree, with lines arranged conveniently around it, and so constructed that both the air and sun could perform their functions. Constructed with 150 feet of line, the housewife is no longer forced to trudge up one line and down another, toting a heavy basket of clothes, as in the ordinary yard, but

to add to her convenience the Hill dryer is so built as to permit its being folded up like an umbrella and removed.

The Hill Clothes Dryer Company has also perfected various types of indoor dryers of the steel cabinet type, produced in sizes for the ordinary household, and for clubs, hotels and institutions, the drying method being supplied by gas, coal, or electricity. Ash sifters are also manufactured by the concern.

Through progressive merchandising, the products of the company are distributed the length and breadth of the land and in foreign countries.

G. A. Sargent is president and treasurer, J. K. Goodhue, vice president and C. H. Thurston is secretary.

THE GEORGE E. DUFFY MANUFACTURING COMPANY

The George E. Duffy Manufacturing Company which utilizes the eleventh water privilege on Kettle Brook, was formed in 1910, when the late George E. Duffy bought the Thayer Mill, and remodeled and enlarged it until now it is the largest factory on the stream. It employs 200 operatives in the production of woolen cloakings and overcoatings.

The corporation has capital of \$822,500, and the plant is equipped with seventeen sets of cards, 102 broad looms, 6,120 woolen spindles, eight pickers and complete dyeing and finishing departments.

THE E. J. CROSS COMPANY

In 1910 Edward J. Cross founded the E. J. Cross Company which is capitalized for \$450,000, employs upwards of 400 men and has built some of the most important structures erected in the county, including many of the leading industrial plants of Worcester. Mr. Cross is president and treasurer, and Ralph U. Cross is vice president of the corporation.

THE HOWARD-WESSON COMPANY

The Howard-Wesson Company was formed as a partnership in 1910 by Austin E. Howard and Alfred G. Wesson and engaged in a wide variety of commercial work, mainly by the half-tone process, and now employs seventy-five operatives.

Austin E. Howard is president, S. F. Clarkson, secretary and Alfred G. Wesson, treasurer, and advertising designs, printing plates, and photo retouching have been added to the original products.

THE RILEY STOKER CORPORATION

Robert Sanford Riley, founder of the Sanford Riley Stoker Company takes rank as one of Worcester's great inventors of the present century. He developed the Taylor mechanical stoker for the American Ship Windlass Company of Providence, R. I., and was president of that corporation from 1905 to 1911, when he sold his interests, and organized the company which bears his name today. He invented and developed the Riley mechanical stoker, which is in use in many of the largest power plants in this country and in England, France, Japan, Australia, India, and other foreign nations. Mr. Riley was appointed by Charles M. Schwab as supervisor of trial trips of steel ships constructed by the Emergency Fleet Corporation, during the World War.

In his all too short career he gained for himself, his alma mater, Worcester Polytechnic Institute, and the corporation which perpetuates

his name, the reputation throughout the United States, as well as abroad, of being one of America's leading combustion engineers, and perhaps the greatest in that field.

He had a genius for invention that seemed to some to be almost super-human. No engineering problem was too vast for him to undertake and solve. Many of his products were revolutionary in the field of combustion, and almost uncanny in their well-nigh human operations. Coupled with his inventive capacity was a lovable personality, an intense interest in his fellow-men and a philanthropy which was exercised in an unostentatious manner to the great benefit of the citizens of the city of Worcester. His passing at the very height of his powers was a heavy loss to the Heart of the Commonwealth.

As a tribute to his memory, his corporation associates, Messrs. F. Harold Daniels, D. K. Beach, Aldus C. Higgins, Charles L. Allen, George N. Jeppson and others have carried on along the same high ethical business lines that he laid down.

Positive evidence that New England is not on the decline is afforded when one studies the rise, growth and present development of the Riley, Stoker Corporation, of Worcester, as there exist but two concerns in the United States carrying a complete line of mechanical stokers, as well as pulverized coal equipment, and the Worcester unit is the only one that markets a natural draft inclined grate type of stoker, thereby making its equipment even more complete than that of its competitor.

The Riley Stoker Corporation is an amalgamation of a number of important concerns, the Worcester corporation first purchasing the units and good will of the Murphy Iron Works, of Detroit, Mich., which concern was marketing the Murphy Automatic Furnaces; next the Underfeed Stoker Corporation of America, then located at Detroit, Mich., which was supplying the market with Jones Underfeed Stokers; then the A. W. Cash Company, of Decatur, Illinois, and subsequently the United Machine & Manufacturing Company, makers of the Harrington Traveling Grate Stoker, of Canton, Ohio, and still more recently the control of the Automatic Control Corporation, of Detroit.

In these purchases is noted the absorption by a Worcester corporation of the assets and good will of five middle-western manufacturing units, and the control of a sixth, thus bringing to Massachusetts the production not only of Riley Underfeed Stokers but also the Jones and Harrington types of stokers, and the Murphy Automatic Furnaces, providing New England with a completely rounded manufacturing unit in the combustion field as well as in pulverized coal installations.

The combustion equipment already manufactured and installed by the Riley Stoker Corporation develops over 6,000,000 boiler horse-power—an almost inconceivable quantity, and one that is nineteen times the force of Niagara Falls.

In the installation of this vast amount of combustion equipment, including all types of mechanical stokers, as well as pulverized coal, the company's engineers have provided an inestimable service to the industries of this and other countries.

The corporation has capital of \$2,500,000 and employs upwards of 500 men. F. H. Daniels is president, James W. Armout vice president, and D. K. Beach, is treasurer and secretary.

SLEEPER & HARTLEY, INC.

In 1911 Frank H. Sleeper, one of the most versatile and prolific inventors of the present century, began the business of designing and building special automatic machinery, and two years later entered partnership with George D. Hartley, under the name of Sleeper & Hartley, the firm being incorporated later as Sleeper & Hartley, Inc. In less than two decades the business has experienced a remarkable growth, extending to practically every country on the globe. During the World War the number and variety of high-speed automatic machines furnished by the concern to the United States Government and to the allied nations to assist in the prosecution of the struggle was almost limitless.

The arsenals and munition factories of Great Britain, France, Italy, Russia, Canada, Australia, Japan and China were equipped with high-speed spring-making machinery, and it is a safe assertion to make that scarcely a shell was fired in any battlefront that was not propelled by springs made on these machines.

During his active working years, Mr. Sleeper has invented, designed and built approximately 375 different machines, the boldness and originality of many of them being equalled only by the uncanny precision of the mechanical details. In every field he approached, he evolved new types of improved machinery, and demonstrated radical and revolutionary advances upon any device previously produced. The early nineties found Mr. Sleeper pioneering in the development of electrical apparatus, including continuous current generators and motors with fields wound in series, shunt, and compound. He produced among other devices a series-wound constant-potential generator, and, in 1891, he built what was probably the first self-starting, single-phase, alternating current motor made in Canada, designing also both alternating current generators and motors of the induction type. Among his other electrical contributions were transformers and automatic voltage regulators for three-wire systems and for industrial generators subject to fluctuations of speed. He was the inventor of several lifting jacks, among them the one well-known as the "Norton Jack."

In the world of machine tools he evolved and patented new types of engine lathes, upright drills, punches and shears, and presses, and in the typographical field he invented and built printing presses, and paper cutters, and other devices. He produced rotary steam engines remarkable for their high speeds and steam economies, as well as condensers and rotary pumps, but perhaps his most outstanding contributions to the industrial progress of the twentieth century were his special wire forming machines, wire rolling machinery of many types, spring coiling and spring winding devices, spring setting, spring grinding and spring hooking machinery. Among his important inventions was the flexible metallic tube coiling machine, and the equally unusual Tungsten filament coiling machine, for producing Tungsten filament of the coiled type in incandescent lamps, which proved to be the keystone of the nitrogen lamp industry. He also produced a noiseless nail machine capable of attaining high speed and unusual productivity.

The company is incorporated with \$250,000 capital and employs 100 skilled men, Mr. Sleeper being president and Mr. Hartley, treasurer, general manager and secretary.

THE GRIFFIN FLOORING COMPANY

The Griffin Flooring Company, incorporated in 1911, is the successor of the old Rice & Griffin Manufacturing Company which began business in Worcester, in the early eighties, and which was followed about 1900 by the W. E. Griffin Company. In 1909 the latter concern discontinued the manufacture of interior finish and devoted its attention to specializing in hardwood flooring. W. E. Griffin was treasurer and manager of the new company until 1925, when Miss Mary M. Daniher, who had been associated with the old and new units since 1907, and who had acted as assistant treasurer and manager for ten years previous to 1925, succeeded Mr. Griffin in these important positions. James C. Powers is president of the company. The corporation has capital of \$35,000.

THE WORCESTER BAKING COMPANY

In 1912, Arthur G. Swanson and Charles O. Swanson organized the Worcester Baking Company and a year later erected a two story factory, 100 by 250 feet, where the famous "Town Talk" bread has since been produced in every increasing quality to meet the demands of the trade. The concern is capitalized for \$50,000 and employs upwards of 100 hands. Charles O. Swanson is president, and Arthur G. Swanson, is treasurer of the corporation.

DE LONG & PREVOST

In 1913, William H. De Long, who had purchased the dental disc manufacturing business established by Charles A. Clafin, formed a partnership with N. E. Prevost, under the name of De Long & Prevost, and in the intervening years the concern has become the largest of its kind, devoted exclusively to the production of dental discs. Upwards of fifty hands are employed by the present partners, P. H. De Long and N. E. Prevost.

THE WORCESTER TIRE FABRIC COMPANY

In 1913 the Worcester Tire Fabric Company was incorporated, with capital of \$550,000, and it now employs upwards of one hundred operatives in the manufacture of cord tire fabrics.

Carl R. Brownell is president, H. J. Adams, vice president, and A. D. Sykes, treasurer, secretary and manager of the concern. They, with George L. Brownell constitute the board of directors.

JOHN BATH & COMPANY, INC.

The history of John Bath & Co., Inc., is really a resume of the personal achievements of its founder, John Bath. After a varied experience of twenty-five years, mostly in the development and perfection of precision grinding machines and measuring devices, Mr. Bath conceived the possibilities inherent in the grinding of threads, especially as applied to taps, thread gages and thread rolling dies.

The present company, a family-owned corporation, organized in 1915, is built on the realization of his work in the art of thread grinding. It was in 1918, during the World War, that its commercial possibilities became apparent. The exacting requirements of government work, parti-

cularly in the making of jigs and fixtures for ordnance, gave an impetus to the art which resulted in pioneering work being undertaken.

For a few years following the Armistice, the benefits derived from thread grinding were not felt, because of the depression in the metal working trades, but by 1923, the John Bath Company experienced a definite and growing demand for its thread grinding work, which resulted in the concern becoming one of the recognized leaders in its chosen field.

Along with other activities, the company developed to a high degree the "Ground from the Solid" process of thread grinding, and also the system of four Bath tolerances as applied to ground thread taps. These two features have always remained distinctive with the concern and have given it the right to a place of eminence among the makers of the highest grade of precision tools.

Today it has a world-wide market for its ground thread taps, thread gages, internal micrometers and thread rolling dies. Mr. Bath holds patents on grinding machines and devices, as well as on the Bath internal micrometer, the master reference ring and other measuring devices.

The history of the enterprise illustrates the fallacy of some of the depressing opinions regarding New England's future. From a small beginning this business, although far removed from sources of raw material and from its principal markets, has grown until it occupies an important place in its field, and its industrial experience illustrates what has been deeply felt but frequently timidly expressed, that New England is still the maker of the world's finest precision tools and the home of the highest type of skilled labor.

The corporation has capital of \$100,000 and employs 150 operatives.

In 1929 it increased its floor space fifty per cent, due to the increased demand for its precision tools and production advanced at least fifty per cent from 1928 to 1929.

John Bath is president and treasurer, J. Chester Bath, vice president, and R. E. Lamb is the purchasing agent and sales manager of the corporation.

THE LIND SHOE & SLIPPER COMPANY, INC.

In 1921 the Lind Shoe & Slipper Company, Inc., was founded by Messrs. E. C. Lindberg, H. C. Lindberg, and G. M. Lindberg, who had learned the shoe business from their father. All three began the production of custom made shoes at the age of twelve years. Later they worked for the Worcester Slipper Company for about fifteen years, and when they engaged in business for themselves they began producing a quality line of felt slippers. Their capital was limited and their production was small, but the volume buyers were quick to recognize a quality line even then in a crowded field of felt footwear. The Lind Shoe & Slipper Company, Inc., grew by leaps and bounds, and it became necessary to move into larger quarters. The firm purchased a model daylight plant of brick, four stories high, with basement. John Franzen was later admitted to the firm.

The Boston offices of the concern are at 207 Essex Street.

G. M. Lindberg is president, J. Franzen, vice president, H. C. Lindberg, secretary and E. C. Lindberg, treasurer of the corporation, which has capital of \$112,500 and which employs upwards of 100 operatives.

THE O. & J. LABELING MACHINE COMPANY

In 1914, Charles H. Oslund and J. Emanuel Johnson formed the Charles H. Oslund Company, and placed upon the market its first automatic labeling machine. In August of the same year the business was incorporated as the O. & J. Machine Company, and from eight employees grew rapidly until within three years 150 skilled mechanics were carried on the rolls. The company owns several valuable patents relating to labeling machines invented by Messrs. Oslund and Johnson, including an ingenious device which labels a can in one operation, another that labels both sides and the stopper of a bottle simultaneously, and crowning machines for placing caps on all styles of bottles. The corporate name is now the O. & J. Labeling Machine Company, and the enterprise is a division of the Liquid Carbonic Corporation.

C. R. Bull is president, and C. G. Carter is treasurer and secretary.

THE ARTER GRINDING MACHINE COMPANY

In 1914, William Arter organized the Persons-Arter Machine Company which, four years later, became the Arter Machine Company. Mr. Arter designed a rotary surface grinder, which was perfected and placed on the market, in 1915.

The concern, now incorporated as The Arter Grinding Machine Company, has capital of \$60,000, and employs upwards of 100 operatives. William Arter is president, Harold Tattersall is vice president, and William Hague, is treasurer.

In 1929 this plant was busier than it had been at any period since the World War. Employment increased about seventy-five per cent that year over 1927, and a night shift was operated in the lathe department supplementing a considerable amount of overtime work by the entire factory. Business was fully 100 per cent above that of the previous year, and production was about a third greater. The automobile industry and allied lines account for nearly ninety per cent of the company's business, with a large volume of orders from the tractor companies and from manufacturers of airplane motors.

THE BELL COMPANY

The Bell Company was founded in March, 1915, with a capitalization of \$15,000, the original equipment consisting of twelve Crompton & Knowles automatic looms, three filling winding units and one dressing frame. This machinery was installed as an experiment to ascertain what type of fabrics could be woven to best advantage on fancy automatic looms. The first products were fancy worsteds for men's wear.

Shortly after war was declared in 1917, the manufacture of shirting flannel for the United States Army was begun and continued on a night and day basis until the Armistice, after which the production of fancy worsteds was resumed.

In 1924 the company began the manufacture of specialty fabrics for the automobile industry, continuing this line on a night and day basis until 1926. During this period it was found that additional equipment was necessary, and in 1925 a new concrete building, containing 300,000 square feet of floor space, with 18 acres of adjoining land, was purchased.

In 1927 machinery was imported from France to manufacture yarn on the Continental or French system, the new equipment consisting of carding, combing, drawing, spinning, top dyeing and vigoureux printing machines. The necessary wool opening scouring, drying and backwashing machinery was procured in this country, and the company now controls all operations from grease wool to the finished cloth.

To supply the demands of customers, production has been increased from 1,200 yards weekly, using 3,500 square feet of floor space and employing eight people, in 1915, to 45,000 yards weekly using 300,000 square feet and employing 600 hands at the present. The equipment includes 180 looms, 2,800 twist and 5,600 worsted spindles, eight worsted cards, twelve worsted combs, complete dyeing and finishing departments, and four boilers.

Merle Bell is president and treasurer of the corporation, which is capitalized for \$480,100. N. Houston is vice president. The success of this concern is but added evidence that Massachusetts is still fertile ground for textile development. In 1929 the company's production increased thirty-five per cent and two shifts were operated much of the time.

THE SHERMAN TEXTILE COMPANY

In 1915 the Sherman Textile Company was incorporated, with capital of \$200,000, to manufacture cotton, silk and rayon fabrics and upholstery goods. Today, the plant is equipped with 140 looms, and the concern employs 150 operatives. F. S. Ewing is president, R. W. Smith, secretary and F. K. Ewing, treasurer.

THE WORCESTER BRAIDING COMPANY

The Worcester Braiding Company was established in 1915, and incorporated four years later, with capital of \$50,000. It manufactures elastic and non-elastic braids and narrow fabrics, tapes, and shoe laces, and operates six hundred braiding machines.

G. P. Findlay is president, H. C. Brothers, secretary, and N. F. Ward, treasurer, and the concern employs forty operatives.

THE LYSETH THREAD COMPANY

The Lyseth Thread Company was incorporated in 1916, with capital of \$20,000, to manufacture cotton thread.

Dugald E. Walker is president, Sutton S. Lyseth, treasurer and manager, and Clifton W. Bell, secretary. Fifty hands are employed in the Hermon Street plant.

THE GREENMAN STEEL TREATING COMPANY

On June 20, 1916, the Greenman Steel Treating Company was established by two wide-awake industrialists, who believed the time was ripe to found a jobbing shop, for the heat treatment of steel. The company began operations the following year, and its modern brick factory, located on Grove Street, may well be described as a service-station, in that line of work, as it is constantly busy treating tools, dies, machine parts, and commercial products shipped to it from all parts of New England.

L. P. Greenman is president and treasurer of the corporation, which has capital of \$10,000.

THE C. A. GROSVENOR SHOE COMPANY

In 1917, Charles A. Grosvenor began the manufacture of felt footwear in a small way, on Austin Street, later removing to Central Street, and soon attaining a daily production of 12,000 pairs of shoes and slippers. In 1922, he purchased the old Joslin factory, in Oxford. The C. A. Grosvenor Shoe Company today employs 200 hands, and is constantly growing.

A Boston office is maintained at 139 Lincoln Street. Charles A. Grosvenor is the sole owner.

THE SMITH MILLS, INC.

The Smith Mills, Inc., were established in 1917 and were incorporated in 1922, with capital of \$400,000. Fancy woolen suitings and overcoatings are produced and upwards of 150 operatives are employed.

The plant is equipped with nine sets of cards, seventy-three broad looms, 2,952 woolen and 200 twist spindles, a picker, a complete finishing department, and two boilers.

Clarence W. Smith is president, Ernest E. Smith, is treasurer, N. H. Sidebottom is assistant treasurer and E. R. Smith is assistant treasurer and clerk.

THE PARKER & HARPER MANUFACTURING COMPANY

On May 1, 1917, Waldo D. Parker organized the Parker & Harper Manufacturing Company for the production of machine screws and allied products.

The company has capital of \$84,000, and employs upwards of fifty operatives.

E. T. Harper is president, J. P. Carlson, vice president and secretary, and Joseph Harper, treasurer.

THE WORCESTER WIRE WORKS, INC.

The Worcester Wire Works, Inc., has been specializing since 1919 in the manufacture of high carbon steel wire. The company's business from a small beginning has been steadily increasing until at the present time it owns five acres of land and mill buildings containing about 100,000 square feet of floor space, with an annual output capacity of finished products of about 7,000 tons. In 1928, it erected an additional building, 210 by 66 feet, two stories high. The plant is situated directly opposite the Jamesville railroad station, and the officers and directors are: Nils Bjork, president and treasurer; Victor E. Runo, vice president and secretary, who, with Herman Bjork and Ellen E. Runo, constitute the board of directors.

The corporation has capital of \$131,000, and surplus of \$241,392, as of December 31, 1927, and employs upwards of 150 operatives.

THE VELLUMOID COMPANY

Among the great discoveries of the present century that are aiding industry and performing a service hitherto lacking in manufacturing operations is the sheet packing evolved by The Vellumoid Company, especially for oil, gasoline and crude distillate connections, which is proof not only against these liquids, but one which does not deteriorate.

Vellumoid is the pioneer packing of its kind, and its characteristics—leak proof, toughness, compressibility, durability, easy cutting qualities, and absence of shellac, commend it as a uniform, quality product on all oil, gasoline, water, air and crude distillate connections where the temperature does not exceed 350 degrees Fahrenheit; in connection with a large number of organic liquids, and solvents, including methyl and ethyl alcohol, ether, acetone, amyl and ethyl acetate, carbon disulphide, chloroform, benzol, and many others; in the retention of particularly difficult liquids, such as carbon tetrachloride and for work with very low temperatures, as in the liquefaction of air in the manufacture of oxygen and the rare gases, such as helium.

The "Spirit of St. Louis" was equipped with Vellumoid on its epoch-making flight across the Atlantic, and whether in airplane or motor truck duty, it withstands hard service.

The corporation has capital of \$125,000 and in addition to producing the Vellumoid packing it manufactures gaskets. It employs seventy-five operatives.

R. B. Stanley is president, and George C. Beals is treasurer and secretary.

THE WORCESTER TEXTILE COMPANY, INC.

The Worcester Textile Company, Inc., was incorporated in 1919, with capital of \$250,000, and manufactures alpaca, fancy mixtures, worsted and mohair weaving and knitting yarns, and employs upwards of 175 operatives. The plant is equipped with 5,000 worsted and 1,200 twist spindles and complete spinning and finishing departments. The weaving unit produces woolen, worsted and mohair dress goods and men's wear, and has twenty-four narrow and thirty-eight broad looms.

Herbert Gregson is president, E. Gregson vice president, and S. Pear-sall, is secretary and treasurer.

The Standard Yarn Company, owned by J. F. and W. H. Kennedy was established in 1919, and manufactures woolen weaving and knitting yarns, the plant being equipped with three sets of cards, and 1,440 spindles.

THE SHEPPARD ENVELOPE COMPANY

The Sheppard Envelope Company was incorporated January 10, 1921, and its present day officers are: J. Warren Sheppard, president; Eugene A. Cahill, vice president; William H. Sheppard, treasurer; N. Myra Glazier, assistant treasurer, and Linwood M. Erskine, clerk.

All are well versed in the art of envelope manufacture having had many years of practical experience in the industry.

For twenty-five years, J. Warren Sheppard was affiliated with the Sherman Envelope Company as its manager and when that unit was sold to the United Drug Company, of Boston, Mr. Sheppard organized the new corporation.

It began business with two envelope machines, which have grown to forty-five today, with a production of a million and a half envelopes per day. The machines used in the plant were built in the company's machine shop from designs and patents granted to William H. and James E. Sheppard. The latter died in 1925 having served as secretary of the company from its incorporation.

Although the youngest in age, the concern is not the smallest in size,

when compared with the other envelope units of Worcester. It manufactures lithographed, printed, plain, and lined envelopes, the latter for the greeting card trade and it also produces Christmas coin and bill containers now so universally used by all banks.

J. Warren Sheppard was born in Barre, July 13, 1880 and began his business experience as an apprentice of Lucius P. Goddard, of Worcester, at the age of thirteen. Four years later, Mr. Sheppard became identified with the Sherman Envelope Company, where soon he was placed in charge of the printing department, being later promoted to the head of the manufacturing end.

Meanwhile, he acquired an interest in the concern and became manager of the company.

The original capital of the Sheppard Envelope Company was \$100,000 which was increased to \$300,000, in 1924.

The corporation now employs 100 operatives.

THE PARKER METAL GOODS COMPANY

In October, 1922, the Parker Metal Goods Company was organized, with \$50,000 capital, to manufacture wire hardware, wire goods, special wire goods and stampings, and outgrowing its original quarters within two years after its formation, removed its operations to the Osgood Bradley Building.

A. H. Parker, who has been prominent in the wire production field for more than thirty-five years, is president, treasurer and general manager, and J. C. Stearns, and J. F. Casey are associated with him on the directorate.

THREE TEXTILE UNITS ESTABLISHED IN 1922

In 1922 the McCurn Yarn Company was incorporated with capital of \$29,500 to produce weaving, knitting and carpet yarns. Michael McCurn is president and Walter T. Johnson, is treasurer. The plant has 3,120 spindles, six sets of cards, and four pickers, and employs seventy-five operatives.

The same year the Lusignan Textile Company was established to manufacture men's and women's woolen and worsted wear fabrics. It is owned by W. H. Lusignan, and ten broad looms are operated.

The Zelkind Waste Company, Inc., was incorporated in 1922, with capital of \$50,000, and produces wool waste. J. S. Zelkind is president and treasurer and Harold Hartwell is secretary.

A TRIO OF TEXTILE CONCERNS SET UP IN 1923

The Holden Knitting Company was incorporated in 1923, with capital of \$25,000 to manufacture golf and sport hose, lumbermen's socks and silk dusting mitts. Charles S. Holden is president, Roger M. Holden, treasurer, and J. F. Roberts, superintendent.

The same year the Worcester Knitting Company, Inc., was incorporated, with capital of \$150,000, since increased to \$250,000, to produce astrachans, stockinette, bathing suits, eiderdowns, woolen worsted and lightweight knitted cloth and sweaters, and the plant is equipped with thirty winders, 120 knitting and 160 sewing machines.

A. S. Persky is president and treasurer, Sidney Davis, vice president

and Joseph Persky is secretary and superintendent. Three hundred operatives are employed.

The Bancroft Woolen Yarn Company was incorporated in 1923, with capital of \$15,000, and manufactures custom yarns. The plant has one set of cards, and 640 woolen spindles. James J. Rae is president, and M. E. O'Donnell is treasurer.

THE WRIGHT MACHINE COMPANY

In 1924, the Wright Machine Company was established, to manufacture machine screw products and metal specialties, with capital of \$250,000, and in April, 1929, the business and realty of the concern were purchased by Archibald R. Lemieux, and a group of associates, and was re-organized under the laws of Massachusetts, with 2,000 shares of preferred stock of \$100 par value, and 4,000 shares of common stock of no par value.

The present officers are: president, Archibald R. Lemieux; vice president, W. Vernon Thomas; treasurer, Louis F. Weber, and clerk, George A. Gaskill.

Upwards of 125 hands are employed by the concern, which closed the year 1928 with an increase of production approximately thirty-one per cent over 1927. Indications for 1929 were that an increase of at least thirty-five per cent would be made that year over the previous twelve months.

The company added to the variety of its products in the hardware specialty and aviation fields in 1929.

INDUSTRIAL UNITS FORMED IN 1924, 1925, AND 1926

In 1924 the Nieber Mills, Inc., were incorporated to manufacture woolens and worsteds and employ seventy-five hands. Oswald Nieber is president and Walter Nieber, treasurer. The company operates twenty-four broad looms and the plant is equipped with a complete finishing department.

In 1925, C. E. Robinson Company, Inc., was incorporated, and produces knitted elastic fabrics. C. E. Robinson is president and treasurer of the corporation.

The same year the Adjustable Spinning Band Company was incorporated, with capital of \$40,000, to manufacture spinning bands, shoe laces and threads, and the plant was equipped with seventy binders. W. B. Scofield was president, H. P. Riccios, secretary and A. H. Steele, treasurer, at the time the assets of the corporation were sold to Thomas Taylor & Son, of Hudson, in 1929.

The Clark Wool Company, Ltd., was incorporated in 1926, to manufacture men's and women's wear, woolens and worsteds. Walter Clark is president and C. J. Fricker, treasurer, and the concern operates twelve broad looms, and employs thirty-five operatives.

The same year the Hillside Woolen Mills Company was established and produces men's and women's wear woolens. H. S. Levy is the owner of the company. The plant is equipped with two sets of cards, thirty-eight narrow looms, two pickers, 576 woolen spindles, complete dyeing and finishing departments, and one boiler, and employs fifty hands.

Sherman Looms, Inc., were incorporated in 1926, with H. F. Sherman as president and treasurer, for the manufacture of corset cloth, upholstery

and tapestry goods, and operate twenty jacquard looms. The concern has capital of \$50,000.

THE WORCESTER SILK MILLS CORPORATION

In 1926, the first large local silk enterprise was incorporated as the Worcester Silk Mills Corporation, with capital of \$350,000, the Fremont Street plant of the concern being equipped with ninety-six box looms, five warpers, and six winders, and the production of broad georgette silks has been carried on since, upwards of 100 operatives being steadily employed.

E. Muelberger is president, Rufus S. Frost, vice president, Harlam T. Pierpoint, treasurer, and Raymond Shutts, superintendent.

INDUSTRIAL DEVELOPMENTS IN 1927

In 1927 the Circlette Manufacturing Company, Inc., was incorporated, to manufacture knitted surgical elastic goods for the corset industry. F. J. Ford is president, Agnes C. Ford, secretary, and D. H. Finnegan, treasurer.

The same year the machinery of the Northboro Brush Company was removed from Northboro, where it had been operating during the previous five years, to Worcester, where more manufacturing space was available.

The Taylor-Hall Welding Corporation bought the weaving plant of the Worcester Textile Corporation, in 1927, and occupies it today in carrying on its electric welding operations, upwards of twenty-five operatives being employed. The corporation has capital of \$50,000. Preston M. Hall is president and treasurer.

SMITH & FYFE, INC.

Smith & Fyfe, Inc., who began the manufacture of Dairimaid ice cream but a few years ago, found it necessary in 1927-28 to erect on Grove Street, one of the most modern and completely equipped daylight plants, in the city, and the distribution of the company's products, formerly confined to the city, now covers all of Worcester County. James G. Fyfe is president, H. A. Smith, treasurer and Alexander B. Campbell, secretary.

ADVANCE OF THE LOCAL SHOE AND SLIPPER INDUSTRIES

Within the past two decades slippers have come to be by far the largest factor in the footwear production of the city, and no other Massachusetts city or town, outside of Haverhill, manufactures so large a total of slippers, as Worcester.

The footwear industry of the city as a whole, which in recent years has grown to large proportions, is advancing by leaps and bounds, and now employs more than 2,500 operatives, with an annual payroll in excess of \$2,250,000.

In 1928, the Melville Shoe Corporation, operating a chain of retail stores, dealing in men's and women's shoes, including the John Ward, Rival and Thom McAn types, selected Worcester on account of its geographical location, railroad facilities and other advantages as the best location for its New England warehouse and distributing center, and erected a two story and basement structure, served by a new siding from the Boston & Albany Railroad irons, provision being made for more stories to the building later. The structure is 336 by 132 feet, of reinforced concrete construction, with red brick curtain walls, and is equipped

with extensive conveying and mechanical handling devices for the expeditious receipt and delivery of stock by trucks, as well as by rail.

THE L. HARDY COMPANY

The L. Hardy Company, formerly L. Hardy & Company, has long been engaged in the manufacture of machine knives, straight cutter ensilage, lawn-mower, meat, cork, rag, and bone cutter knives, shearing blades and strips for cotton and woolen goods, die cutter stock for boots and shoes, and all kinds of welded stock, as well as wood-working machine knives, planers, moulding knives and blanks, and paper-cutting, leather-splitting and stripping knives.

The corporation has capital of \$25,000 and employs fifty operatives. A. W. Blackmer is president and J. A. Browning is treasurer.

THE WARREN BELTING COMPANY

J. F. and C. G. Warren began the business now operated by the Warren Belting Company, the concern later becoming the J. F. and W. H. Warren Company, previous to its incorporation under its present name.

It has capital of \$350,000 and employs 100 operatives. W. A. Place is president, C. E. Mason, secretary, W. H. Warren, treasurer and F. E. Alexander, assistant treasurer.

THE WICKWIRE-SPENCER STEEL CORPORATION

The Worcester plants of the Wickwire-Spencer Steel Corporation really have a history which extends back to 1812, as it was in that year that Windsor Hatch and Charles Watson, began experiments in fine wire drawing, in the house of Jacob Watson, in Spencer, the metal being drawn from two tubs by hand. They were followed by Elliot Prouty and by 1820 wire drawing became an established industry in a small way, in Spencer.

In 1847 Messrs. Myrick and Sugden succeeded to the business and for a half century thereafter Richard Sugden, who became president of the Spencer Wire Company, remained active in the industry, until at the time of his death, in 1895, the product of the Spencer plant reached 1,332 tons annually. Upwards of twenty buildings constitute the unit, at Spencer, and approximately 2,500 tons of finished wire are produced there yearly.

In 1899 the Worcester plant was built, in New Worcester, where about thirty acres of land are owned, the main structure being 350 feet long, and four stories high, with another building 550 feet long, three stories high, and a third, 560 by 60 feet, three stories in height, which with ten other structures afford a manufacturing area in excess of seven and one-half acres.

The Morgan division of the Wickwire-Spencer Steel Corporation is located at Barber's Crossing.

THE FLEMING MACHINE COMPANY

In 1929 the Fleming Machine Company turned over its small tool division to the then newly-formed Fleming Manufacturing Company, Inc., of which G. W. Fleming became president, S. B. Wilson, vice president and general manager, and Charles F. Davis, treasurer.

The new company is manufacturing and marketing the Fleming line

of precision tools, the Fleming screw driver and the Marnall steel lubricating pits.

Mr. Fleming is chairman of the International Trade Committee of the National Standard Parts Association. Mr. Wilson was formerly president of Wilson & Co., and sales manager of the Service Station Equipment Company and assistant sales manager of the McCord Radiator & Manufacturing Company, while Mr. Davis is president of the Stafford Iron Works, Inc. George W. Fleming is president and Frank W. Proctor, treasurer of the Fleming Machine Company, which has capital of \$90,000 and employs 150 operatives.

OTHER INDUSTRIES OF WORCESTER

Early in 1929 the International Footwear Company, of New York City, established a factory at Jackson and Beacon streets, where a large quantity of new machinery of the latest type was installed for the manufacture of felt and leather slippers, 400 operatives being employed. The corporation has capital of \$150,000. S. Bernfeld is president and H. Weisinger is secretary.

The same year the General Baking Company, of Boston, erected an addition to its Worcester plant, at a cost of \$200,000.

The Worcester Yarn Mill, owned by Thomas J. Hayes, Thomas Ashworth and G. N. Hathorne is engaged in the carding and spinning of woolen yarns. The plant is equipped with two sets of cards, 720 mule spindles, three spoolers and a twister.

Fred R. Smith owns and operates the Tatnuck Mills, where woollens are produced. Fifty hands are employed, and the equipment includes two sets of cards, thirty-six narrow looms, 576 spindles, a picker, a complete finishing department, two boilers, and one water wheel. George A. Deroches, Jr., is superintendent.

The Sterling Worsted Mills employ 125 operatives in the manufacture of fancy worsted and piece dyes, having eighty broad looms, 488 twist spindles, complete dyeing and finishing departments, and two boilers. D. O'Connell is the owner of the concern.

The American Wool and Waste Exchange, owned by J. R. Weinstein, deals in shoddy, picked, garnetted and carded stock, and the plant is equipped with five sets of cards, two garnets and two rag pickers.

The Johnson Steel & Wire Company, Inc., one of the latest additions to the city's metal trade industries found it necessary in 1928 to build a substantial addition to its plant, on Wiser Avenue, in order to take care of increased business and to permit it to diversify its products.

Charles D. Johnson is president of the concern and in 1929 he reported that both employment and production were running about fifty per cent in excess of the figures of 1927. George G. Johnson is secretary and Bernard A. Johnson is vice president and treasurer.

The Viko Shoe Company employs fifty operatives in the manufacture of women's comfort shoes, and has its Boston office, at 78 Lincoln Street. Victor J. Johnson is president and treasurer, C. Oscar Lindberg, vice president, and Helmer P. Johnson, secretary.

The J. H. Mannix Shoe Company, one of the city's recent footwear acquisitions, produces women's McKay shoes.

The National Felt Slipper Company, Inc., has capital of \$25,000, and manufactures felt slippers. H. J. Golumbuk is president, and Irving P.

Sawyer, is treasurer and secretary and the concern employs 100 operatives.

The Manning-Cook Shoe Company produces shoes at its plant, 110 Gold Street, has capital of \$50,000 and employes 100 hands. Edward A. Manning is president, and A. E. Cook, treasurer and vice president.

N. C. Neilsen manufactures golf vests, sweaters and sweater coats.

The Worcester Elastic Stocking & Truss Company is engaged in the production of anklets and wrists, surgical elastic hosiery and supporters, the plant being equipped with seventeen knitting and twenty-five sewing machines.

H. D. Brewer is president, J. R. Owen, treasurer, and A. W. Litchfield, manager.

The John H. Stevenson Company owned by John H. Stevenson manufactures silk, nainsook and rayon underwear, and employs seventy-five operatives.

The Taylor-Brown Manufacturing Company, capitalized for \$100,000 produces brass castings and finished bronze bushings, the partners being Walter B. Taylor and Gerald A. Doe.

The Thompson Wire Company, with capital of \$400,000 employs 150 operatives in the production of fine tempered wire and steel, George M. Thompson being president and treasurer and Allan L. Cowperthwaite, secretary. The capacity of the company's Worcester plant was doubled in 1928. It also operates a factory at 41 Mildred Avenue, Boston.

The Warp Compressing Machine Company, with capital of \$50,000, employs forty men in the production of textile machinery, A. L. McTaggart being president, and M. S. McTaggart, treasurer.

The Weber Piano Company, a subsidiary of the Aeolian Company of New York City, employs 175 operatives in its Worcester factory, in the production of pianos and piano cases.

The New England High Carbon Wire Company, with capital of \$300,000 has its headquarters at 340 Main Street, and its plant at Millbury, where high carbon wires are manufactured, Carl T. Lund being president, Alfred J. Jacobson, secretary and Frank Kilmer, treasurer. One hundred hands are employed by the concern.

The New England Slipper Company, capitalized for \$50,000, and of which J. L. Fairweather is president and treasurer, employs 100 operatives in the manufacture of felt, satin and leather slippers.

The Park Manufacturing Company employs forty operatives in the production of door checks, metal covered doors and builders' hardware. A branch plant is operated at 360 Columbus Avenue, Boston, Evan F. Jones being president and treasurer of this \$50,000 corporation, and Morris Rosenfield, vice president.

The Peck Shoe Company, with capital of \$235,000, employs 150 operatives in the manufacture of shoes, Frederick S. Peck being president, John M. Travers and James P. Smith, vice presidents, and Albert E. Godfrey, treasurer, of the corporation. The company's Boston office is at 10 High Street.

The Persons-Majestic Manufacturing Company is engaged in the manufacture of bicycle and motorcycle accessories, being capitalized for \$75,000, and employing from 80 to 100 operatives. Charles A. Persons is president, Alexander M. Persons, vice president, and Harold K. Dexter, treasurer.

Frank H. Pfeiffer is president and treasurer, and K. L. Pfeiffer secretary, of F. H. Pfeiffer Company, Inc., manufacturers of house slippers, the concern employing seventy-five operatives.

Richard P. Power, William M. Power and Edwin P. Power, as co-partners, operate the R. P. Power Foundry Company, employing seventy-five men in the production of grey iron castings.

Robert G. Pratt employs fifty operatives in the manufacture of supplies for narrow fabric looms and also produces silk bobbins.

The Worcester Steel Products Company, of which Maurice F. Reidy is president and treasurer, and P. F. Coe, secretary, manufactures threading tools, taper pins and piston pins, and is capitalized for \$150,000.

The Worcester Last Company, Inc., manufactures shoe lasts and stretchers, and is capitalized for \$50,000. George A. Stevens is president Albert L. Lentz, secretary and Robert P. A. Taylor, treasurer.

The Worcester Electric & Manufacturing Company produces electric switchboards, and employs fifty operatives. James P. McGrady is president, Peter T. McGrady, vice president and Joseph McGrady, treasurer.

The Worcester Film Corporation, of which F. H. C. Coppus is president, F. A. Ramsdell, treasurer, and L. M. Erskine, secretary, specializes in motion picture films, and during recent years has made some notable industrial productions.

The Worcester Foundry Company, with capital of \$200,000, employs 125 men in the production of iron castings, Frank Hayes being president, and Thomas J. Finn, treasurer.

The White & Bagley Company capitalized for \$328,339, employs sixty hands in the manufacture of oils, lubricants and soaps, H. P. Bagley being president, and E. G. Bagley, treasurer.

The Peter Wood Dyeing Company employs fifty operatives in dyeing and bleaching, Robert J. Wood being president and Peter Wood, treasurer, of the corporation.

Woodbury & Co., Inc., with capital of \$125,000 produces photogravure and die-stamped letterheads, John C. Woodbury being president, and Harold C. Woodbury, treasurer and secretary. More than one hundred hands are employed.

The Bangs Fixture Company specializing in drug store fixtures has its principal office at 41 Arctic Street, maintains a Boston branch at 247 State Street, and operates its factory in Reading, some fifty hands being employed. C. L. Bangs is president, and H. D. Brewer, of Brewer & Co., is treasurer.

The George A. Barnard Company, a partnership which includes George F. Barnard, R. A. Barnard, and Walter A. Barnard, employs fifty operatives in sheet metal and roofing work.

The Leon J. Barrett Company owned by Leon J. Barrett employs twenty-five in the manufacture of centrifugal oil extractors and dryers.

A. I. Asher & Sons, a partnership made up of A. I., Benjamin and Jacob Asher, employs seventy-five operatives, at their Harding Street factory, in the manufacture of trousers.

The Atlas Die Casting Company, with capital of \$200,000 employs eighty hands in the production of die castings, E. G. Norman being president, and A. B. Campbell, treasurer of the corporation.

The Central Autogenous Welding & Manufacturing Company capitalized for \$50,000, specializes in welding, John A. Braithwaite being presi-

dent, Charles H. E. Coster, vice president, Andrew M. Sargent, treasurer, and George Braithwaite, secretary.

The Commonwealth Screw Company owned by Iver Johnson manufactures screw machine products, the concern having capital of \$40,700.

The Carling Turbine Blower Company, of which Axel W. Carlson is president and treasurer, and Albert L. Carlson, is vice president, is capitalized for \$85,000, and employs forty operatives in the manufacture of steam turbines and blowers.

The Carlton Engraving Company specializes in photo engraving, employing thirty-five operatives. Herbert E. Carlton is president and treasurer, and A. H. Lawton, secretary.

Forbes & Myers, owned by Allan W. Forbes, is engaged in the manufacture of electric grinding machines.

The Fremont Casting Company, with capital of \$50,000, employs fifty operatives in producing grey iron castings. Edwin H. Marble is president, Herbert A. Davis, is vice president, and Charles F. Marble is treasurer of the corporation.

Hollander & Johnson, Inc., manufactures dies, tools and rubber moulds, S. G. Hollander being president and treasurer, and Frank Tupper, secretary of the corporation. The corporation has capital of \$20,000, and employs twenty-five operatives.

The F. L. Hunter Corporation, with capital of \$700,000, employs 100 hands in manufacturing asbestos products, Allan H. Sturgis being president, and Harry C. Garland, treasurer.

The Harper Screw Products Company, capitalized for \$84,900, employs fifty hands in the manufacture of screw machine products, E. T. Harper being president, J. P. Carlson, vice president and secretary, and Joseph Harper, treasurer.

The David Gessner Company, capitalized for \$250,000, employs 100 operatives in the manufacture of cloth finishing machinery, David Gessner being president, and J. P. Franklin, treasurer of the concern.

The Gifford Screw Products Company, of which Albert W. Blackmer is president and Bulkeley Smith, treasurer, produces screw machine products, mills special parts from bars, manufactures cap screws, set screws and machine screws, and conducts the only brass warehouse in Worcester County.

The Mills Corset Company, capitalized for \$100,000, employs sixty hands in the production of corsets, Ward L. Crosby being president, and E. R. Mills, treasurer and secretary.

McDonald & Corcoran, owned by Charles J. McDonald, is engaged in producing asbestos, textile and paper machinery, and employs fifty hands.

The Latons Manufacturing Company employs 100 operatives in the manufacture of hose supporters, suspenders and garters, the concern being owned by Charles A. Latons.

William J. Woods, for many years the active head of the W. J. Woods Company, dealers in men's clothing and furnishings, is also president of the Quinsigamond Pressed Steel Company engaged in the manufacture of pressed metal products, and employing fifty operatives. The corporation has capital of \$25,000 and W. A. Dean is treasurer.

The Reed Small Tool Works, with capital of \$65,000, is engaged in the manufacture of micrometer calipers, E. Howard Reed being president,

Edward E. Lothrop, treasurer, and Donald D. Simonds, secretary of the corporation.

Seventy-five skilled operatives are employed by the Rogers Drop Forging Company, of which J. R. Rogers is president, and F. P. Rogers, treasurer, this concern specializing in drop and machine forging and electric welding.

W. P. Rowell & Son, Inc., of which corporation H. M. Rowell is president and treasurer, employs fifty operatives in the manufacture of shirts, sleeping garments and bathrobes.

The S. M. Sargeant Company, with capital of \$150,000, employs fifty operatives in the production of flavoring extracts and toilet requisites, Stephen M. Sargeant being president and treasurer, and B. F. Jeffery, secretary.

The Frank E. Sessions Company, capitalized for \$75,000, and employing 100 hands, is engaged in the manufacture of caskets, Frank E. Sessions being president and treasurer, and Thomas J. Kerns, vice president, of the corporation.

James and W. B. Smith, as partners, operate the firm of James Smith & Son, and employ fifty men in the production of textile machinery.

The M. K. Smith Corporation, with capital of \$40,000, employs fifty hands in the manufacture of builders' finish, George A. Johnson being president, and M. K. Smith, secretary and treasurer.

The Stafford Iron Works, Inc., employ sixty operatives in fabricating structural steel, light and miscellaneous iron, the concern having capital of \$25,000. Harry A. Hall is president, C. F. Davis, treasurer, and J. E. Bigwood, assistant treasurer.

The Standard Radio Corporation employs 115 operatives in the production of radios, Charles M. Stewart being president, Ben W. Fink, vice president, and Herbert Midgley, treasurer.

The W. M. Steele Company employs fifty hands in the production of special machinery, F. J. Munson, being manager of the plant. The partnership consists of Nellie J. Steele and Clara Steele Munson.

Winfred S. Griffith is the owner of the Robbins Machine Company, employing forty operatives in the manufacture of lathes and special machinery. Mr. Griffith is the inventor of a successful magnetic chuck, the patent rights of which he sold to the Heald Machine Company and he has designed, patented and built many machine devices.

The William Coupe Corporation, capitalized for \$200,000, employs twenty-five operatives in the manufacture of lace leather and cut lace, Frank H. Willard being president, M. D. Ball, secretary, and C. A. Bartlett, treasurer.

The Culver-Stearns Company, employing 250 operatives is another of the numerous industrial concerns of Worcester engaged in purveying accessories to the automotive trade, its lighting equipment being distributed throughout the country. J. C. Stearns is president and treasurer.

John S. Cushman & Company, owned by John S. Cushman and Harold C. Sanderson, is engaged in the manufacture of shoes, employing 250 operatives. This concern exports ten per cent of its products to Porto Rico, Cuba, and Jamaica, and the greater proportion of its domestic business is with mail order houses.

The Deering Corset Company, of which Charles M. Deering is presi-

dent and treasurer, is engaged in the manufacture of corsets, and employs thirty-five operatives.

The Felt Goods Company, owned by A. E. Cook, capitalized for \$50,000, employs forty operatives in the manufacture of slippers.

R. B. Field & Company, of which concern R. B. Field is president and treasurer, employs 100 operatives in the production of leather paper, fibre, felt, cork washers, packings, and automobile gaskets.

The Stearns Pressed Metal Company, of which E. L. Stearns is president, and E. H. Carroll, treasurer, employs thirty operatives in the production of metal stampings.

The White, Pevey & Dexter Company has capital of \$800,000 and employs 275 hands in the manufacture of pork products.

The Worcester Gear Works, Inc., has capital of \$25,000 and produces gears. H. O. Anderson is president, and N. A. Bennett, is treasurer and secretary.

Dining cars are manufactured by the Worcester Lunch Car Company, which has capital of \$30,000. Thirty-five hands are employed. Philip H. Duprey is president, Charles P. Gemme, vice president, and Irving M. Stoddard, treasurer and secretary.

The Worcester Pressed Aluminum Company employs fifty operatives in the manufacture of tacks and metal stampings. The corporation has capital of \$50,000. C. A. Brosnan is president and treasurer.

The Worcester Products Company has capital of \$200,000, and employs fifty operatives in the production of beverages. Michael J. Finnegan is president, and Herbert A. Maynard, is treasurer and secretary.

The Worcester Wind Motor Company employs forty hands in the manufacture of piano and radio supplies. Victor J. Johnson is president and treasurer, and H. P. Johnson, is assistant treasurer.

The J. O. Young Company, of which Judson O. Young is president, employs twenty-five operatives in the production of ladders. The concern has capital of \$22,000.

The A. A. Brunell Company, Inc., of which A. A. Brunell is president and treasurer, is engaged in plating and employs 100 operatives.

The C. & B. Cycle Manufacturing Company manufactures bicycles and accessories. Phillips M. Case is president, and Stuart R. Bugbee is treasurer, of the corporation.

The Central Machine Works has capital of \$25,000 and employs thirty operatives in the production of automobile parts. J. Gauch is president, H. J. Schaefer, vice president and secretary, and M. Schaefer, treasurer.

Elliot & Hall, a partnership made up of Edward and Roland F. Hall, manufacture cloth folding and measuring machines.

C. L. Goodwin & Company, Inc., employs forty operatives in the production of store fixtures. A. S. Goodwin is president and E. C. Goodwin, is treasurer and secretary.

The Houghton Manufacturing Company manufactures stamped steel products, and employs twenty-five operatives. L. T. Houghton is president, and J. M. Houghton, treasurer and secretary.

A. E. Jewell & Company, owned by Albert E. and John A. Jewell, employs thirty operatives in the production of duck suits and overalls.

McMahon & Company, a partnership made up of A. J. and A. E. McMahon, employs twenty-five operatives in the manufacture of friction clutches.

The Nutting Manufacturing Company employs twenty-five hands in the production of metal stampings. G. H. Stearns is president, J. C. Stearns, treasurer, and Charles H. Prior, secretary.

Frederick M. Ramsdell is president, treasurer and secretary of the Ramsdell Tool & Manufacturing Company, which has capital of \$25,000, and is engaged in the manufacture of metal stampings and tools.

The Shephard Manufacturing Company, of which Warren S. Shephard is president, Frank L. Shephard, treasurer, and L. J. Shephard, secretary, has capital of \$50,000 and produces telephone plates.

The Ringer-Worcester Company is engaged in the manufacture of steel boxes, display cabinets, Ringer filing equipment, and steel products, at its plant located at 489 Shrewsbury Street.

The American Dry Plate Company, of which Frank B. Waite is president, has capital of \$20,000, and is engaged in the production of ferrotype plates.

A branch of the American Optical Company, of Southbridge, is operated in Worcester.

The Baker Lead Manufacturing Company, of which James H. Baker is president and treasurer, has capital of \$20,000 and is engaged in the manufacture of lead products.

The Barta-Griffin Company, with capital of \$50,000, manufactures printers' inks, in its Portland Street plant, and maintains a service branch at 148 Pearl Street, Boston. William E. Barta is president, Daniel E. Griffin, treasurer, and A. A. Holland, assistant treasurer.

Emery wheels are manufactured by the Bay State Emery Wheel Company, which is owned by H. F. Sanderson.

A. L. Bemis employs thirty operatives in the production of patterns and cabinet work, in his Commercial Street plant.

Fred I. Blake manufactures small tools, calipers and dividers, in his factory, at Washington Square.

The Blaney Manufacturing Company, Inc., with capital of \$30,000, produces shoe laces. Peter Wood is president and treasurer, William J. Wood, is vice president, and M. L. Wood, is secretary.

The Bliss Leather Packing Company owned by S. W. Bliss manufactures valve leathers and washers.

The Alfred L. Brown Associates, Inc., has capital of \$20,000 and produces electric motors. F. M. Shaw is president, K. A. Brown, secretary, and Alfred L. Brown, treasurer and vice president.

The L. B. Darling Company, a subsidiary of the Consolidated Rendering Company, employs thirty operatives in the manufacture of tallow.

Moore & Company, Inc., capitalized for \$96,000, is engaged in the manufacture of pharmaceutical supplies, and employs thirty operatives. Frank E. Allen is president and treasurer.

The Superior Tool & Manufacturing Company, Inc., manufactures special machinery, tools, jigs, fixtures, and wire drawing machinery, and has capital of \$100,000. It employs thirty operatives. Ivar W. Alin is president; Olaf G. Johnson, vice president; Carl E. Tideman, secretary, and R. Williamson, treasurer.

The Taylor-Hall Welding Company, of which Preston M. Hall is president and treasurer, has capital of \$50,000 and employs twenty-five in electric welding operations.

Thomas & Company, Inc., makes a specialty of producing church fur-

niture, and employs twenty-five operatives. Richard G. Dick and August W. Dick are the partners in the enterprise.

The Wakefield "All Steel" Wrench Company, of which C. E. Wakefield is president and treasurer, employs fifty operatives in the manufacture of wrenches.

The Worcester Ornamental Iron Company employs twenty-five operatives in producing iron and bronze work. D. E. Clark is president and H. L. Dow, treasurer.

Samuel J. Agboy employs forty operatives in the manufacture of garters, at his plant on Cross Street.

The American Oxidaze Company has capital of \$50,000 and produces medicinal tablets. F. H. Hamblin is president, and Walter D. Tyler is treasurer and secretary of the corporation.

The Anderson Corporation, of which G. H. Anderson is president, S. Malcolm Blanch, secretary, and F. J. Quist, treasurer, manufactures wire brushes and electric drill tools.

Anderson & Patterson, Inc., employs sixty hands in the manufacture of confectionery and ice cream, and has capital of \$200,000. William Patterson is president, Charles Anderson, secretary, and George Anderson, treasurer.

The William B. Bacheller Company, Inc., manufactures cigars and employs fifty hands. The corporation has capital of \$50,000. William H. Bacheller is president and treasurer, and A. F. Bacheller, secretary.

The Barton Shoe Company is capitalized for \$25,000 and produces children's shoes. O. A. Atkins is president, C. A. Doonan, secretary, and B. E. Heath, treasurer.

The Bay State Elevator Company of Springfield, maintains headquarters in Worcester, at 393 Main Street.

Loring Coes & Co., Inc., has capital of \$150,000 and manufactures machine knives. The corporation employs 150 operatives. Frank L. Coes is president and treasurer, Frederick Searle, vice president, and Charles Rose, secretary.

The Commercial Welding & Machine Company manufactures special machinery, and is capitalized for \$10,000. G. A. Olin is president and treasurer, and M. Olin is secretary.

The Crompton-Scofield Manufacturing Company has capital of \$59,600 and manufactures textile machine parts. George Crompton is president, Hermann P. Riccius, vice president, and W. Emory Wardell, treasurer and secretary.

The Cutting Die & Machine Company of America, Inc., which is capitalized for \$625,000, operates one of its three Massachusetts plants at 26 Plum Street, the other units being located in Lynn and Brockton. It produces cutting dies and machinery, and employs 150 operatives. James V. Knox is president, Orvis M. Savels, secretary, Orvis M. Savels, Jr., treasurer, and Joseph K. Knox, George A. Gumbs, Joseph E. Tougas and John Dews, vice presidents.

The G. & N. Machine Company, Inc., has capital of \$50,000 and employs twenty-five hands in the manufacture of machinery parts. Arthur L. Guerin is president and treasurer, and Leo E. Caron, secretary.

The Victor Hedlund Company, Inc., manufactures kitchen equipment and is capitalized for \$50,000. J. Victor Hedlund is president and treasurer, C. B. Hedlund, secretary, and Ralph V. Hedlund, vice president.

The Wiley-Bickford-Sweet Company ranks as one of the largest producers of slippers in Massachusetts and employs 500 hands at its plant at 60 King Street. The corporation has capital of \$800,000 and maintains a Boston office at 183 Essex Street. E. A. Bickford is president and W. A. Sweet, treasurer and clerk.

The Worcester Lawn Mower Company employs seventy-five operatives in the manufacture of lawn mowers. S. D. Loud is president and treasurer, and George A. Gaskill is secretary of the corporation.

The J. Nelson Manning Shoe Company, Inc., has capital of \$85,000 and employs 350 operatives in the manufacture of women's and children's McKay shoes. J. Nelson Manning is president and treasurer, George W. Moholland, vice president, George K. Winchester, secretary, and A. C. Bacon, assistant treasurer.

INCREASING POWER DEMANDS OF WORCESTER'S INDUSTRIES

A survey made by the New England Power Association of power furnished by its wholesale companies and consumed in manufacturing plants reveals a true picture of increasing industrial activity in Worcester, as well as in the remainder of the large territory served by this far-reaching power system. The analysis compared power consumed in the first quarter of 1928 and 1929 and indicated improvement in many lines of local manufacturing, including textiles. Some, notably metals, increased in a large way.

The economic case of Worcester is striking. In the first three months of 1929, the local plants receiving power from the New England Power Association's companies consumed 41,437,000 kilowatt hours, at the rate of 165,000,000 kilowatt hours per annum, an increase of more than seven millions, or 21.2 per cent over 1928. These plants included some of the big local concerns, among them the American Steel & Wire Company, the Osgood Bradley Car Company, the Norton Company, the Heald Machine Company, the Wyman-Gordon Company, the Morgan Works of the Wickwire-Spencer Steel Company, and the Worcester Pressed Steel Company.

The Power Association's industrial customers outside of Worcester used 36,501,000 kilowatt hours, an increase of nearly two and one-half millions, or 7.2 per cent.

Consumption of power is a close measure of manufacturing output.

The comparison of the two periods as made in the survey was essentially fair, as all plants were excluded from consideration excepting those to which power was furnished in both of the three months' periods. Customers who had been added in the intervening months and new departments of plants of old customers did not figure in reaching the 1929 total. The distribution of power represented was on a scale so broad and in volume so great—at the rate of more than 300 million kilowatt hours per annum—that the increases recorded must constitute a dependable record of local prosperity.

The most extraordinary change in plant activities was noted in the metal industries, which consumed 25,498,000 kilowatt hours, an increase of more than six millions, or 33.8 per cent.

The improvement noted in the textile industry, while small, was sufficient to indicate a wholesome beginning of a wholesome trend upwards.

Eleven jobbing iron foundries in Worcester and vicinity produced 3,841,380 pounds of castings in January, 1929, as compared with an output of 2,914,072 pounds, in January, 1928, or an increase of 31 per cent.

CHAPTER LIII

FITCHBURG

ONE OF THE GREAT PAPER AND TEXTILE CENTERS OF THE EAST

Fitchburg is one of the industrial cities of Massachusetts which early became interested in manufacturing because through its terrain there ran the north branch of the Nashua River, not a sizeable stream to be sure, in comparison with the Connecticut and Merrimac, but one which, between the town lines of Westminster and Leominster has a fall of 250 feet, which the industrial pioneers early discerned furnished to them a hand-maiden that spelled prosperity, wealth and dependability for power to such plants as might be set up along its banks. Today, steam and electric energy operate the factories of the city, the river being used more as a medium through which the industrial wastage can be absorbed than as a source of power.

The industrial growth of Fitchburg dates from about 1750, when the first crude dam was thrown across the river, and saw and grist mills were built. Soon after the revolution a custom fulling mill was erected, where, with Fuller's earth, wool was scoured and grease removed, and, subsequently, a carding mill and a clothing mill, where cloth was brought for dyeing and shearing from the settlers' homes.

While Fitchburg had these few small factories soon after the Revolutionary War, her real industrial development did not begin until the first quarter of the nineteenth century, the initial paper mill being built in 1805; the first cotton mill in 1807, at which time it ranked as the second of its kind in Massachusetts and as the third in the country; the first woolen mill in 1822, while iron and steel manufactures, which for many years have distinguished the city, did not make their advent until 1838.

The cotton mill referred to was a two-story brick building, 30 by 60 feet, which is still standing, and forms a part of Mill B, of the Parkhill Mills, recently merged with the Amoskeag Manufacturing Company of Manchester, N. H.

In 1822 the operations at this original cotton mill were changed to woolen production, and for sixty-five years the Fitchburg Woolen Mill manufactured a quality of goods "all wool and a yard wide" equal to that made in any New England factory.

In 1864 other local woolen mills came into being, among them the present Arden and Beoli units of the American Woolen Company.

Fitchburg, however, was not considered as an important textile center until 1880, when the manufacture of gingham was begun, to be followed by the Orswell, Grant and Fitchburg yarn mills, and the reopening of the Star Worsted Mill, built fifteen years before. This group gave to the community high rank among the textile cities of Massachusetts.

THE CITY RANKS SECOND TO HOLYOKE AS A PAPER PRODUCER

It is in paper and pulp production that Fitchburg is best known. It is little appreciated by the man on the street, however, that the city of Fitchburg now ranks second to Holyoke in the value of its paper output, and with completion of recent enlargement of plants, the latter's supremacy will be at least threatened, if not exceeded. Paper products constitute two-fifths of the value of Fitchburg's total industrial products. The number of its employees, however, is less than that of cotton goods.

In 1920 local production was practically four times that of 1914. The low year was 1921; but while Holyoke's production declined 66 per cent in 1921 from the peak, Fitchburg's decline was only 53 per cent. It has shown steady recovery since 1921.

The following table pictures the progress of Fitchburg's paper industry during the past several years:

Years	No. of Mills	Value of Stk. & Mat. Used	Wages Paid	Aver. No. Workers	Value of Products
1919 -----	5	\$13,601,380	\$2,152,918	1,743	\$18,605,861
1920 -----	5	18,077,231	2,857,132	1,848	27,240,491
1921 -----	4	8,360,452	1,808,534	1,533	12,818,067
1922 -----	3	10,215,466	2,082,065	1,636	15,390,453
1923 -----	4	12,072,146	2,435,031	1,718	18,309,988
1924 -----	4	12,013,837	2,601,241	1,744	18,626,822
1925 -----	4	11,579,867	2,628,119	1,841	18,752,074
1926 -----	4	12,087,649	2,820,928	1,830	19,706,322

THE CITY'S INDUSTRIAL ENTREPRENEUR—ALVAH CROCKER

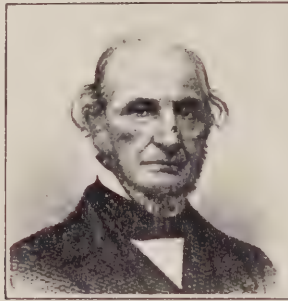
The growth of Fitchburg as a manufacturing center is largely due to the enterprise of one man, Alvah Crocker, the founder of the present Crocker Burbank Company.

Born in Leominster, October 14, 1801, his father was a "vatman, or coucher," in the Nicholls & Kendall paper mills there, but his earnings were meager and insufficient to support the family. His mother, of the old John Adams' stock, kept her sons from the poor-house, by putting them on farms, during the summer months, to "dress corn," plow and rake hay.

At the early age of six years Alvah Crocker was thus engaged and when but eight, he was permanently placed in the Leominster paper plant, and, from that time, until he was sixteen, earned for his mother, from \$1.50 to \$3 per week, exclusive of board. Usually, he had eight weeks of schooling, but he recalled that in 1813 he had but two. By night study, however, he kept abreast of his class. For a part of the time he was permitted to work in the paper mill nights, earning about four cents per hour, which pittance, his mother, poor as she was, allowed him to keep, and at sixteen years of age he had accumulated \$50, which he spent in tuition and board at Groton Academy, and next teaching school in order to earn money enough to return another year. In 1820 he returned to the manufacture of paper in Franklin, N. H., and three years later he removed to Fitchburg, where he was employed in a paper mill

until he was able, on borrowed capital, to erect a plant of his own, at "Old Crockerville."

The years 1827-29 were disastrous for American business, and Mr. Crocker was further retarded in his progress by a freshet that damaged his mill. His embarrassments were also aggravated by the attitude of the farmers in the vicinity of his mill who feared that an increasing manufacturing population might vitiate the morals of the town, and this feeling was intensified by their being obliged to make a road to his mill.



ALVAH CROCKER
of Fitchburg
To whom that city is more
indebted as a manufactur-
ing center than to any
other man

At that time Mr. Crocker was disposing of his product to a Boston commission house against the rags and chemicals he purchased, and when he received his quarterly statement it appeared that some of his product had sold well, and some to men of straw, while the commission house informed him "they had concluded not to guarantee," leaving against him a large balance in their favor. He had not, up to that period, made any profit; he owed \$12,000 on the original investment, which, with the commission debt of \$4,000 more, totaled \$16,000, and he needed \$10,000 with which to buy paper-making machinery, as it was evident the day of hand-work paper was passing.

His property, located as it was, would, under forced sale, give little to his creditors, and although his old debts were carefully distributed, his commission debt, although not due, was unscrupulously demanded.

He saw but one course was left to him and that was to sell his paper directly to consumers and open barter accounts, with yearly settlements only, for all the stock he needed. Added to this stock was his cotton waste in making white paper. He worked on during the day, frequently taking his product, during the following night, to Boston, until 1834, and having the greatest difficulty in paying both debt and interest.

That year he was employed by the town of Fitchburg to secure a road further up the Nashua Valley, and the landowners opposing the proposition, and demanding exorbitant prices for their realty, he purchased the entire valley terrain to the Westminster town line, and thus laid the foundation of his subsequently acquired fortune, as well as securing the site for his future paper plants.

In 1835 Mr. Crocker was elected to the Massachusetts Legislature,

and the following year voted in favor of a state subscription of \$1,000,000 to the Western Railroad.

HOW ALVAH CROCKER MET A CRISIS

He endeavored, without success, at this period, to arouse the citizens of Fitchburg and vicinity to the vital importance of rail connection with Boston, either by a branch line to Lowell, which already had been tapped, or to the Worcester trunk line, at Framingham, and he expended considerable sums of his own money in making surveys, his slogan being: "Northern Massachusetts must have steam communication with tidewater, or fade away into utter insignificance." Later, both surveys he made to Lowell and Framingham were adopted by the railroad companies. Then came the financial panic of 1837 when few of his customers were able to meet their notes when they became due. He had scrupulously paid his protested notes as they came back to him, until his resources were completely exhausted. Never having failed to meet his paper he was driven almost to distraction. It was his cardinal policy not to mortgage any property he owned. Examining his notebook he found that if all outstanding paper were to be returned dishonored, \$10,000 would meet the bank portion of his liabilities. He prevailed on the cashier of the Fitchburg Bank to allow his protested paper to accumulate until the Monday forenoon of each week. On one Wednesday, previous to the weekly settlement, he found sleep out of the question and in his fevered imagination he conjured images of jail and a beggared family, until, at last, an hallucination obsessed him that a debt, due him from a family he had supported in the South, for three years, would be paid and that the debtor would reach Fitchburg the following Saturday, and settle with him, although he was well aware that the man was a bankrupt. His repeated assurances to Mrs. Crocker only served to give credence to her belief that her husband's brain was affected. Following his Saturday morning breakfast, after another sleepless night, Mr. Crocker harnessed his horse, "Old Whitey," and rode to town, where he met the identical debtor before the dooryard gate where his family resided, just as he was confident he would. "Come in and get your money. You did not let my poor family suffer, did you? What on earth ails you? What do those tears mean? Southerners will always pay a debt of honor!" continued the man.

After satisfying the debt, the Southern emissary drew from his pocket another package of currency, saying "Here, my boy, take that." Mr. Crocker waved the proffer aside and told his friend that he could offer no security on account of the uncertainty of the times. The reply was: "You trusted me, and fed my children. I shall trust you." Mr. Crocker hastened to the bank, called for the batch of protested notes he was confident had arrived, and was asked by the cashier: "What are you going to do, Crocker?" "Pay?" was his reply. "Where? How? When?" "Money, sir," said Mr. Crocker, at the moment uncovering from his old, rusty pocketbook, two large packages of bills. Such was the paucity of currency at the time that the cashier began to doubt what he saw, and in consternation exclaimed: "I vow, Crocker, did you steal it?"

Better years followed, although fire leveled his largest mill, with a large storehouse filled with paper and white rags, upon which there was little insurance.

HIS CAREER AS A RAILROAD BUILDER

In 1842-3 he was re-elected to the Legislature, and obtained a charter for what was later known as the Fitchburg Railroad, being denounced as a humbug and imposter by the lobbyists of rival lines who were opposed to this new artery of transportation unless they could build it themselves, and being successful against tremendous odds he secured the required financial aid and built the road, triumphantly riding into Fitchburg on the first locomotive on March 5, 1845. Elected the first president of the Fitchburg Road he resigned the following June to accept the presidency of the Vermont & Massachusetts Railroad until it should be completed, and resigned that position when the rails were laid to Brattleboro. From 1843 to 1850 he was engaged largely in railroad enterprises, materially aiding the Troy & Boston and the Tunnel Railroads, and became the dominating factor in the building of the Hoosac Tunnel.

In addition to his paper manufacturing interests, Mr. Crocker was also engaged as a chain and machinery manufacturer, but these businesses were wiped out on November 9, 1849, in one of the most disastrous fires that ever visited Fitchburg.

When he came to Fitchburg, in 1823, and shortly afterwards took over the operation of the paper mill that had been built by Gen. Leonard Burbank, to replace one destroyed by fire, the town was a village of 1,200 inhabitants, and three years later when he decided to go into business himself in the pioneer mill where he began making ledger caps, he was first obliged to clear a swamp before he could build his little mill.

In 1835 he purchased the Burbank mill, where he was first employed in Fitchburg, and which site he soon covered with mills, and foundries, erecting the first machine shop and foundry ever built in the city. He was the first to use palm-leaf as a fibre for manufacturing coarse hanging, or wall paper, softening it with strong alkali and bleach.

From the day when, in 1826, Alvah Crocker built his first mill, the association of the name Crocker with the paper industry of Fitchburg has been continued without interruption by the same family for more than one hundred years, and today the concern is one of the largest producers of high-grade paper in the country.

The eight mills of the Crocker-Burbank Company today employ 1,200 hands.

FROM 100 POUNDS TO MORE THAN 400 TONS OF PAPER EACH DAY

At the beginning of the nineteenth century the initial output of the first local paper mill was 100 pounds a day, while the existing Fitchburg paper plants of 1927, running from near the Westminster line to the borders of Leominster, turned out more than 400 tons of paper every twenty-four hours. Times have changed since the first paper manufacturer of Fitchburg drove his own team over a devious path to Boston to dispose of his product, and to bring back a load of material and supplies. Today a single consignment of Crocker-Burbank Company's product designed for the Curtis publications, at Philadelphia, requires many freight cars, and were not shipments made frequently, entire trainloads would be operated.

For ninety years this concern has made book papers and ever since the Curtis Publishing Company took over the *Saturday Evening Post*,

the *Ladies' Home Journal* and the *Country Gentlemen*, the Fitchburg Corporation has supplied the great enterprise with its products.

Back in 1881, forty-seven years ago, it operated five paper-making machines, which produced fifteen tons of paper daily. Today it operates nineteen machines and produces 315 tons of paper every twenty-four hours.

In 1878 it paid taxes to Fitchburg on a valuation of \$236,780. In 1928, fifty years later, it paid taxes to the city on a valuation of \$6,636,450.

In 1928 a new method of handling pulp in paper-making, through the washing process, was invented and patented by the Crocker concern, and is now being used at the plant. The slide washer, as it is called, replaces the old method of handling the pulp several times, the new washer requiring but one handling of the raw material.

The present officers of the corporation are Alvah Crocker, president and treasurer; Charles T. Crocker, vice president, and Bartow Crocker, secretary, and Messrs. Alvah, Charles T., Douglas Bigelow, C. T. Crocker III, John J. Riker and I. T. Burr constitute the board of directors. The concern employs 1,200 operatives.

THE FITCHBURG DUCK MILLS

In 1830 George Blackburn built the factory, that in 1844, became the Fitchburg Duck Mills, where for 100 years have been fabricated the best grades of duck fabrics, which have found a constant market throughout this country and the South American republics.

Today the concern employs 200 operatives, in the manufacture of felts. The concern was incorporated in 1905, with \$100,000 capital, and today the plant is equipped with 4,480 ring spindles, sixty-four broad looms, two boilers and two water wheels. E. B. Richardson is president, and Thomas C. Sheldon is the secretary and treasurer of the corporation.

THE GENESIS OF THE SIMONDS SAW & STEEL COMPANY

Almost one hundred years ago Abel Simonds and J. T. Farwell purchased the mill privilege at West Fitchburg, where, in 1832, they built the shop that formed the nucleus of the present-day Simonds Saw & Steel Company.

In 1851 the partnership, known as J. T. Farwell & Co. was dissolved, and Abel Simonds continued the business until 1864, when he retired, and his sons, Alvan A. and George F. Simonds, with Benjamin Snow, established the firm of Simonds Brothers & Company, which, four years later, became the Simonds Manufacturing Company. Up to that period the products had been confined to mower and planer knives, but, in 1878, the former line was abandoned, and the manufacture of saws was begun, the concern employing an entirely new system of tempering and straightening, radically different from anything then in vogue.

Beginning with circular saws, the products were diversified to include cross-cut, band, and hand-saws. George F. Simonds served as president until 1888, and was succeeded by Daniel Simonds who filled the office until his death, in 1913. Under the latter's administration, the concern grew by leaps and bounds, establishing branch offices in Chicago,

San Francisco, New Orleans, Portland, New York City, Seattle, Montreal, St. John, N. B., and Vancouver.

In 1892 a factory was erected, in Chicago, and eight years later a steel mill was established there, which was removed to Lockport, N. Y., in 1911. In 1905-06 a large factory was placed in operation, in Montreal. The same year the manufacture of hack saw blades was undertaken in a separate factory, which soon required extensive additions, to take care of the sales demands. In 1913, Alvan T. Simonds was elected president, and holds that position today. In 1922, shortly after opening a branch, in Detroit, the company sold its assets in the Simonds File Company to a new corporation known as the Simonds Saw and Steel Company, capitalized at \$2,800,000, and in all the plants of the concern upwards of 2,200 persons are employed, more than 700 being carried on the payroll, at the local plant. The corporation recently absorbed the Abrasive Company of Philadelphia, which is now operated as one of the units of the Fitchburg Corporation.

Fitchburg-designed and manufactured machinery is internationally known. The saws made by the Simonds concern cut more trees and prepare more logs for the market than those of all other makers in the United States combined, while the largest circular saws in the world are produced at the Fitchburg plant.

A. T. Simonds is president, H. K. Simonds, treasurer, and G. K. Simonds, general manager, of the corporation.

THE ADVENT OF THE PUTNAM MACHINE COMPANY

The town of Ashburnham was the birthplace of the Putnam Machine Company. In 1836 John and Salmon W. Putnam began business there, under the firm name of J. & S. W. Putnam. A year later they removed



S. W. PUTNAM
of Fitchburg
Founder of the Putnam
Machine Company, now a
unit of Manning, Maxwell
& Moore

to Fitchburg, where they became interested in repairing cotton machinery, employing only an apprentice, and occupying a room, 20 by 30 feet, in the old Burbank paper mill.

From the repairing of old, to the creative development of new machinery was but a step. The mills in the vicinity of Fitchburg supplied the incentive and with their orders the business grew and pioneered in the production of native American lathes.

Their first manufactured product was a gear cutter, production of which gave them a start and led to the development of a full line of standard tools.

In the rooms of the Fitchburg Historical Society is the first Putnam lathe, built in 1836, while in the company's plant, one of the early Putnam planers, built in 1885, is still seen in running condition.

Since 1836 various installations of Putnam machinery have found their way into practically every important metal-working plant and railroad shop in America, as well as in many foreign countries.

Salmon W. Putnam was an inventive genius and soon patented an upright drill, with a swinging table, enabling the operator to move the work about under the drill without unclamping. Next he invented the Universal Hanger, and other devices.

In 1849 the original plant was destroyed by fire, and the brothers carried no insurance, but they promptly repaired the damaged machinery, built a shed over it, and were producing machinery within two weeks thereafter.

In 1866 the present "old" plant was built, and at about that period they began the building of the Putnam engine, which became famous in this and many foreign countries. The company was intimately connected with the early development of the rock drill, and the first successful drills used in the Hoosac Tunnel, together with the compressors, were designed and built in the Putnam shops.

In 1866 the concern built a machine shop 625 feet long by 45 feet wide, with seven large ells and foundries, covering an area of 15 acres, which was considered at that time as the last word in machine shop construction. The plant was unexcelled in size in the East. A little later an iron foundry, 150 by 60 feet, was erected.

The company had the distinction of furnishing the machinery for the first two machine shops established in China.

Branching out into still a broader field, the concern began the manufacture of machinery suitable for the equipment of railroad shops.

In 1913 the Putnam Machine Company was acquired by Manning, Maxwell & Moore, Inc., of New York City, and on May 15, 1914, a policy of expansion was inaugurated, when ground was broken for the present-day plant, built wholly of steel, concrete and brick, and as near fireproof as possible. In October, 1927, the Shaw-Crane-Putnam Machine Company, Inc., was formed to operate the Putnam plant, at Fitchburg, and the Shaw Crane Works, at Muskegon, Mich., both owned by Manning, Maxwell & Moore, Inc.

Lathes engaged in turning the shafts of the world's largest battleships, for cannons, rifles, and the machine trade in general, have been manufactured here and are a part of the equipment of the great Krupp gun works at Essen, Germany.

Four hundred hands are employed at Fitchburg and the corporation has capital of \$5,000,000. C. A. Moore is president, F. W. Knowles, vice president, and F. M. Kreiner, treasurer and secretary.

THE CITY'S DIVERSIFIED INDUSTRIES

In 1842 Walter Heywood began the manufacture of chairs, employing ten hands at the outset, but within twenty years he carried 150 men

on his payroll, with as many more women and children caning and seating chairs in their homes, as was the custom of the period.

In 1849 the original plant was destroyed by fire, but was immediately rebuilt on a larger scale, and in the sixties consisted of three large buildings, two of them being of brick, the main structure being 130 by



WALTER HEYWOOD
of Fitchburg
Who, in 1842, founded the
Walter Heywood Chair
Company of that city

40 feet, three stories in height; the other brick building, 80 by 40 feet, four stories high, and the frame structure being 140 by 32 feet, three stories high. There were also auxiliary dry houses, varnish rooms and other small buildings connected with the works. Sixty-five dozen chairs per day were turned out, practically all of which were exported in knocked down form.

A. D. Waymouth began the building of lathes in Fitchburg, in 1857, and in 1875 formed, with his son, the firm of A. D. Waymouth & Co., which during its early career manufactured and sold upwards of 3,500 machines. It is still producing wood-turning lathes today and is owned by R. H. Alison and Hon. Marcus A. Coolidge.

WILLIAM A. HARDY & SONS COMPANY

William A. Hardy founded the present day firm of William A. Hardy & Sons Company, in 1861, when he took over a business that had been started eleven years before. He built his original plant on approximately the same location where the factory stands today. In 1876 Mr. Hardy, with Charles Pinder, engaged in the manufacture of screen plate, a patent being granted that year to Hardy who, with his partner, placed upon the market the first cast bronze screen plate ever fabricated in the United States, and soon their products found their way into practically every paper and pulp mill in the country.

These original plates were the first ever cast in the sand, those formerly used being of rolled metal. A separate company, known as Hardy & Pinder, was formed, in 1876, to market this specialty.

In 1891 Pinder retired and the business was merged with the Hardy concern, which, in 1902, was incorporated by the sons of the founder, under its present name. The senior Hardy also invented and patented several different types of journal bearings, which were generally used on railroad cars. In 1910 the Hardy concern became the sole manufac-

turers of the Spring-Lockwood screen plate fastener, a patented device for fastening screen plates without screws.

Capitalized for \$300,000 the Hardy unit affords employment to 125 operatives in the manufacture of high quality brass castings, the officers, Hon. W. A. Hardy, president; W. C. Hardy, secretary, and C. S. Hardy, treasurer, all being descendants of the founder.

C. H. Brown came to Fitchburg in 1849 and the following year with Charles Burleigh, of rock-drill fame, secured a patent for the engine which eventually entered the market as the "Putnam."

In 1863 he opened a shop of his own, and three years later moved to the plant that later became known as the Fitchburg Machine Works. Here, in 1871, he designed and patented the multiported gridiron valve engine which bears his name. Two years later he built a new factory, on Willow Street, where he continued business until 1899, when he retired, and his sons succeeded him until 1911, when the Fitchburg Foundry Company which had been conducted since 1885 by M. J. Perault, was merged with the Brown unit, under the name of the Brown Engine & Machine Company with Moses J. Perault, Sr., as president, and M. J. Perault, Jr., as treasurer and manager. In 1915 the latter, with his brother, Joseph F. purchased the business.

In 1864 Eli Culley began the manufacture of files on a small scale in North Weymouth, removing to Fitchburg four years later where he continued in business up to his death, in 1890, when the business was taken over by his sons, F. C. and W. E. Culley.

THE FITCHBURG PAPER COMPANY

On December 31, 1864, the late Rodney Wallace organized the West Fitchburg Paper Company with Stephen Shepley and Benjamin Snow, and, purchasing the Lyon paper mill, and the Kimball or Fitchburg Scythe Shops, at West Fitchburg, began the manufacture of paper, becoming the sole owner on January 1, 1869. In 1878 a new brick mill was erected, and two years later, another was built, which increased the production to six tons a day, and in 1887 another large addition was made.

In recent years the plant has been greatly modernized and extended under the administration of the son of the founder, Col. George R. Wallace, and the latter's son, Major George R. Wallace, Jr., and by 1913 the production had been stepped up to 75 tons per day. Since that time it has been more than doubled by large additions.

Capitalized for \$800,000, employing 400 operatives, and specializing in card and lithograph papers, the Fitchburg Paper Company is the city's second largest paper-producing enterprise, and produces book paper and wall paper foundation.

Col. George R. Wallace is president and treasurer, Major George R. Wallace, Jr., vice president, Frederick Wallace is assistant treasurer, and M. F. Dunn is clerk of the corporation. The Messrs. Wallace constitute the board of directors.

75 PER CENT OF ALL THE SCREEN PLATES MADE IN THE WORLD
ARE PRODUCED HERE

The Union Machine Company was incorporated in 1867 by Francis Sheldon, G. C. Burbank, and others, to manufacture steam fire-engines, but five years later the production was changed to paper machin-

ery. Prior to 1903 the manufacture of screen plates, which had grown to be an important local business, was carried on at the machine company's plant, but the demand for this product was so extensive that the Union Screen Plate Company was organized.

Not only was the first cast metal screen plate ever fabricated turned out in Fitchburg, but today 75 per cent of all the screen plates manufactured in the world are produced in the plants of the Union Screen Plate Company, which concern is capitalized for \$50,000, and employs fifty operatives, and is commonly accepted as being the largest screen plate unit in the world, and in the factories of the Fitchburg Screen Plate Company and W. A. Hardy & Sons Company. Emmons Crocker is president and A. S. Morse, secretary and treasurer of the Union Screen Plate Company. Walter S. Hall is president and treasurer, and V. C. Hall is secretary of the Fitchburg Screen Plate Company, which has capital of \$50,000, and employs twenty-five hands.

In 1867 H. W. Pitts formed the Fitchburg Cotton Mill for the manufacture of cotton warps.

The same year Charles Burleigh invented the first successful steam drill, and incorporated the Burleigh Rock Drill Company, capitalized for \$120,000. The first use of the product on a large scale was in the construction of the Union Pacific Railway, when it was extensively and successfully employed in the deepest cuts and most difficult tunnels of that road. Later it bore a prominent part in the excavation of the Hoo-sac Tunnel, and the early Panama and Nicaragua Canal companies used many of these drills, while miners and railroad builders throughout this country and Mexico, Central and South America employed it in their operations.

In 1870 David M. Dillon established the D. M. Dillon Steam Boiler Works, which for sixty years have been numbered among Fitchburg's progressive and leading industries, and of which the founder's sons, D. Frank Dillon is president; Frederick N. Dillon, treasurer, and W. S. Dillon, secretary. The company is capitalized for \$300,000 and employs 100 men. Adjoining the plant is the Union Foundry Company, of which corporation D. Frank Dillon is president and treasurer, Fred N. Dillon, vice president, and B. G. Anderson, secretary. The concern employs thirty men in the production of grey iron castings.

The Fitchburg Steam Engine Company was formed in 1872 upon the failure of the Haskins Steam Engine Company, and for more than fifty years has manufactured single cylinder and compound horizontal and vertical engines, which have been installed in all parts of the United States and have carried the name of Fitchburg to the power plants of some of the biggest corporations in the country. Its installations for electric-lighting companies have been extensive. The corporation has capital of \$100,000 and employs eighty operatives. R. M. Sherman is president, R. C. Fosdick, vice president, A. A. Tenney, treasurer, W. J. Harrison, secretary, and M. L. Ziegler, assistant treasurer.

THE PARKS-CRAMER COMPANY

Parks & Carpenter started business in 1872 to carry on general plumbing and steam-fitting. Six years later, G. M. Parks, one of the partners, bought out Carpenter. As was originally intended, the steam-fitting

and piping business was continued until 1901, when the G. M. Parks Company was incorporated.

In 1907 the company acquired the agency to manufacture and install the Turbo Humidifier, as invented by Albert W. Thompson, mechanical superintendent of the Amoskeag Manufacturing Company, and eleven years later the G. M. Parks Company bought out the humidifier business of Stuart W. Cramer of Charlotte, N. C., and the Parks-Cramer Company was formed.

The main office of the company is situated in Fitchburg and other offices are maintained at Boston and Charlotte, N. C. The company gives employment to about 350 hands, and does a general business in air conditioning, both humidifying and de-humidifying, also steam heating, both high pressure and vacuum, fuel economy, plant analyses, automatic sprinklers, piping cut to sketch, pipe and fittings from stock.

H. M. Parks is president, and R. S. Parks, treasurer of the corporation, which has capital of \$589,800.

JOHN PARKHILL—A TEXTILE GENIUS

In proportion to their number the mortality among industrial units is almost as great as among human beings, but in almost all instances one can place his finger on the causes of the death of going concerns, and generally they are found to be either the drying up of the market for the type of commodity produced; the indifference of the corporation executives toward the business; the retention of obsolete and worn-out machinery, which fails to produce quality products comparable to those manufactured by competing concerns; the growth of "dry rot" in the production and marketing policies of the company, or the assumption of the idea that the concern is self-sufficient in its chosen field and that a policy of splendid isolation offers a better solution of its problems than a plan which comprehends coöperation with other manufacturers in the same or similar fields of industrial endeavor.

The city of Fitchburg has recently suffered the loss of its largest manufacturing unit—one established less than fifty years ago by the man to whom the municipality perhaps owes more than to any other citizen of his day and generation. In 1880, the late John Parkhill began the manufacture of gingham in a modest four-story building, 48 by 150 feet in dimensions, operating at the start only thirty looms. A thorough student of textile production; sensing the desires of the consuming public; desirous of making a contribution to the industrial welfare of his city; prudent, thrifty, ingenious, energetic and not afraid of hard work; active early and late at his mill, where he took cognizance of the minutest detail of designing, producing and marketing his product; interested in providing steady and increasing employment to his operatives; assiduously devoting his hours to the growth and development of the factory he had conceived and refraining from outside activities, he early produced the subsequently celebrated "Toile du Nord" fabrics, fine gingham and dress goods, whose market was constantly enhanced, until he achieved a reputation in the field of textile production that became the envy of his competitors. He saw the original thirty looms grow to more than 1,500 during his lifetime and the little four-story building develop into three mammoth factories, known as "A," "B" and "C," while the total of original employees, so few that one might almost count them

on the fingers of two hands, was increased to 850. To him this phenomenal growth was gratifying and he took the utmost pride in the thought that his close personal attention to every detail had produced an enduring industrial institution which for years after his demise would go on to even greater heights, achieve lasting renown, and be a perpetual monument to his initiative and zeal.

Although the Parkhill Mills grew until 4,000 looms were in operation and 1,500 employees were carried on the rolls the time came when it seemed desirable to the management to sell the assets to the Amoskeag Manufacturing Company, of Manchester, N. H., of which corporation the Parkhill Manufacturing Company is now a division.

Many employees who had been borne on the rolls for a generation and who had invested some of their earnings in modest homes found themselves suddenly bereft of their daily earnings. But what was still harder for them to bear was the thought that they must seek new pastures for their services and perhaps part with their little homes at a substantial sacrifice on their investments. It was indeed a cataclysm for them and for the municipality.

Since the sale to the Amoskeag Manufacturing Company, most of the factory units have been sold and taken over by old and new corporations and machinery has been installed in the vacant areas, but time alone will serve to heal the wounds caused by the cessation of operations of the former great corporation.

THE FALULAH PAPER COMPANY

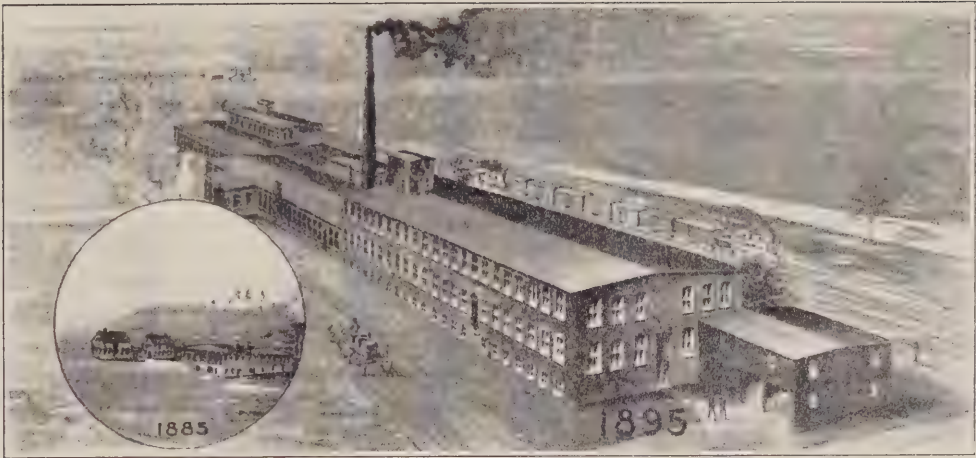
The Falulah Paper Company was founded in 1885 by Albert N. Lowe, who, with his uncle, Seth L. Lowe, bought the plant then known as the Snow Paper Mill. Originally the output was chipboard and news board, with a daily production of about ten tons. In 1893, coating machines were installed and the manufacture of coated box board was begun.

About 1905, this line was discontinued and production was concentrated on the manufacture of coated blanks and cardboards. The daily output now exceeds fifty tons, which is over five times the original production of the mill.

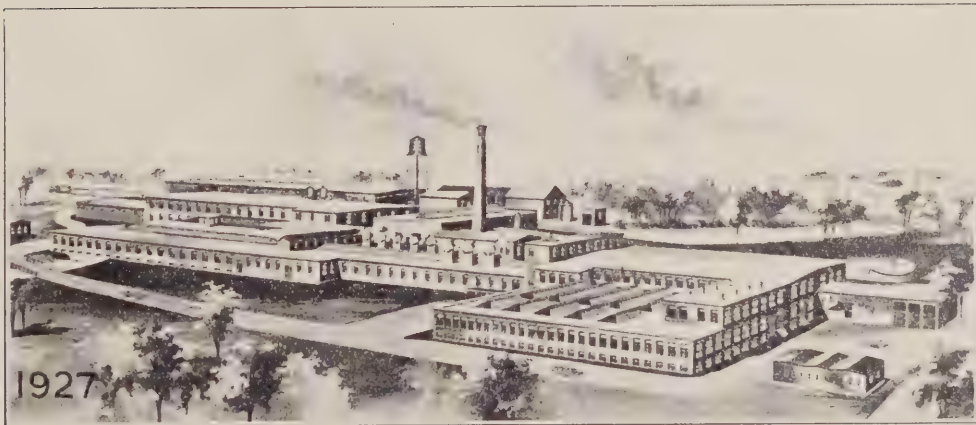
The officers of the company are Erving F. Lowe, president, and Hon. Joseph A. Lowe, secretary and treasurer; both being sons of the founder of the company. The latter served as mayor of the city for several years.

The concern has capital of \$200,000 and employs 250 hands.

In 1885 the late Herbert E. Jennison and James H. Mack took over the enterprise founded by A. A. Spear & Co., then conducted by the C. M. Converse Company, and as Mack & Jennison broadened the line of activities, until in 1923, at the time of the incorporation of the Jennison Company with \$260,000 capital, about 250 men were employed. When, in 1907, the Blake Pump & Condenser Company was incorporated, Mr. Jennison became its dominating factor, its products being in great demand during the World War, when general pumping machinery and hydraulic apparatus were urgently needed. Following the death of Alexander Thomson, of Fitchburg, the inventor of zinc horse collars, Mr. Jennison became the head of the Thomson Company which succeeded the thirty-years-old Thomson Steel Horse Collar Company and broadened its field of distribution. W. H. Dolan is president and treasurer, and W.



FALULAH PAPER COMPANY, FITCHBURG, 1885 AND 1895



FALULAH PAPER COMPANY, FITCHBURG, 1927

H. Dolan, Jr., secretary of the Jennison Company. William B. Hewitt is president and treasurer, M. E. Kendall, vice president, and G. H. Hewitt, secretary of the Blake concern, which has capital of \$100,000 and employs 150 hands.

In the three companies upwards of 400 hands are today employed.

In 1887, following the death of C. M. Flint, the famous sawmill inventor, F. S. Lovell, bought the patents and business and continued the production of sawmill machinery of various types.

THE BENDIX-COWDREY BRAKE TESTER, INC.

In 1875 Charles H. Cowdrey founded the Cowdrey Machine Company and for more than fifty years the concern has engaged in designing and building special machinery, having manufactured products for mining operations as far away as Japan and Australia. The delicate instrument known as the Petrotome is manufactured in the Cowdrey shops, being used to cut geological specimens, such as crystals and fossils, at any required angle, and of such thinness that the sections may be used as microscopic slides. Textile and printing machinery is also produced. On the death of the founder, in 1896, Henry E. and Charles F. Cowdrey succeeded to the management. The C. H. Cowdrey Machine Works still continues in operation and has capital of \$200,000. H. E. Cowdrey is president, C. W. H. Cowdrey, vice president, G. B. Warner, secretary, and C. F. Cowdrey, treasurer.

The corporation employs 200 hands. In 1929 the business of the Cowdrey Brake Tester Organization, Inc., was acquired by the Bendix Aviation Corporation, and a new company, the Bendix-Cowdrey Brake Tester, Inc., was formed, with its headquarters in Fitchburg, where a complete line of brake tester equipment is now being manufactured.

Vincent Bendix was elected chairman of the board, and Charles F. Cowdrey, Sr., who developed the equipment, is honorary vice president. All brake patents, appliances, etc., belonging to the Bendix Aviation Corporation were combined with those of the Cowdrey organization. The machines of the concern are in service in upwards of 700 service stations in the United States and in twenty-two foreign countries.

IVER JOHNSON—A NAME KNOWN ALL OVER THE WORLD

The Iver Johnson's Arms & Cycle Works, occupying five brick buildings, containing 200,000 square feet of manufacturing space, are the outgrowth of the firm established in Worcester by Iver Johnson and Martin Bye in 1871, which occupied a single room, in a Church Street structure, in that city. In 1883 Mr. Johnson bought his partner's interest, and conducted the business under the name of Iver Johnson & Co. His fine mechanical skill as a gun maker was combined with inventive genius and he not only devised patterns for small arms, which he protected by patents, but he foresaw the future of the bicycle and, in 1885, placed upon the market the Iver Johnson model, and soon began turning out 1,000 a year, and within five years the annual output rose to 15,000. Seeking more factory space, he purchased the Walter Heywood Chair Manufacturing Company's plant, in Fitchburg, and enlarged it.

Today the company maintains wholesale depots in New York, Boston, Worcester, San Francisco and Chicago, branches in Canada, England and Australia, and the output of small firearms and shotguns is

greater than that of any other concern in this country engaged in the production of these commodities. It is also turning out more bicycles than in the heyday of the craze of the '90s.

Every sixty seconds it turns out three revolvers; every two minutes it fabricates a shotgun, and every four minutes it manufactures a bicycle.

Capitalized for \$600,000, upwards of 600 employees are carried on the company's payrolls.

It is still controlled by sons of the founder,—Hon. J. Lovell Johnson, who is its president, and Walter O. Johnson, its treasurer,—and the corporation takes rank in the industrial world as being the oldest continuous manufacturer of bicycles in the world.

THE STAR WORSTED COMPANY .

In 1894, Charles B. Smith and Charles T. Crocker purchased the Star Worsted Company, which was established in 1881, and in 1912 the former became sole owner of the concern, which, in the thirty-five years of his management has grown to be one of the city's leading industries, now employing upwards of 400 employees, and being housed in a modern plant. The concern is capitalized for \$150,000, and the plant is equipped with 13,712 worsted and 5,510 twist spindles, eleven worsted cards, and eleven worsted combs, three boilers and two water-wheels. Charles B. Smith is president and treasurer, and P. W. Flint, secretary.

THE LOUIS DEJONGE COMPANY

In 1900, the most recent addition to the paper industries of the city was made, when the Louis Dejonge Company acquired the former, and then almost new, plant of the Mitchell Manufacturing Company and began to coat paper supplied by other mills, for art work, illustrated literature, and lithograph printing, by a process which is comparatively new, and which was invented by Max Emil Dejonge. Starting in a modest way, the corporation is now capitalized for \$520,000 and employs upwards of 200 operatives. Ernest N. Zentgraf is president, Max Emil Dejonge, treasurer, and George R. Peabody, secretary.

In 1903, the Shirreffs Worsted Company was established, at South Fitchburg, by Col. George R. Wallace and John Shirreffs, for the manufacture of men's fine worsteds and is capitalized for \$150,000 and equipped with 100 looms. It employs 250 operatives and operates as a branch of the Aetna Mills, of Watertown. W. H. Clafin, Jr., is president, C. N. Chase, secretary, and D. A. Haig, treasurer.

In 1904, the Fitchburg Horn Goods Company was organized to manufacture celluloid goods, and today employs sixty operatives. A. P. Mason is president, George V. Upton, treasurer and George V. Upton, Jr., secretary.

While shoe manufacture has never been seriously claimed for Fitchburg the city boasts at least one sizable plant, with a record extending back to 1905, when C. Willis Bennett began the manufacture of women's, misses' and children's shoes. Today the C. W. Bennett Shoe Company, Inc. employs 125 hands, has capital of \$40,000 and turns out 1,500 pairs of shoes each working day, having taken over the factory erected in 1892 by E. F. Belding. D. A. Boyle is president, G. L. Ashe, vice president, G. H. Gillis, secretary and C. Willis Bennett, treasurer.

Burnside E. Sawyer organized the Fitchburg Pin Company, in 1907, which, three years later, became the Diadem Manufacturing Company. In a little more than twenty years, Mr. Sawyer has so increased the production of celluloid goods manufactured at the plant as to command the services of 150 or more operatives. He is president and treasurer of the concern, which has capital of \$50,000.

The Fitchburg Yarn Company was organized in 1907, and the plant is equipped with 60,000 ring and 12,000 twist spindles, 150 cards and five boilers. The company is capitalized for \$1,400,000 and employs 400 hands in the production of cotton yarns. Jesse P. Lyman is president, Frank W. Lyman and M. T. Thoma, vice presidents, Robert S. Wallace, treasurer, and F. N. Dillon, secretary.

In 1909, A. E. Vincellette and S. G. Cushing, the former then possessing thirty years experience in the enameling industry, and Mr. Cushing having long been engaged in the wood turning business, founded the Fitchburg Enamel Company in a small plant, to which two large additions have since been made, affording a total baking capacity of ten ovens. The company specializes in enameling bobbins with a waterproof finish, while knife and brush handles are turned out in baked waterproof enamel. A. E. Vincellette is vice president, treasurer and general manager, V. S. Vincellette, president, and H. V. Hodgkins, secretary, of the corporation, which has capital of \$50,000 and employs thirty operatives.

Within the past fifteen years, Fitchburg has gained importance as the center of the production of children's clothing by the advent of the Frederick H. Sprague Corporation, which employs 125 operatives, and by the formation of the Fitchburg Garment Company by Mr. Sprague, and Russell B. Lowe, to manufacture children's dresses, 100 operatives being employed by this concern.

Parkhill Mill "A" was purchased by the Sprague concern, in 1928, and the Fitchburg Weaving Company took over a portion of the plant, and entered upon the manufacture of weaving rayon fabrics, with 126 looms and 110 employees, while the Sprague Corporation enlarged its operations. Russell B. Lowe is president and W. A. Flight is treasurer and secretary of the Fitchburg Weaving Company which has capital of \$100,000.

The Rodney Wallace Company was incorporated in 1916, with \$150,000 capital, having been operated by the founder as a cotton wiping waste mill for many years prior to his death, in 1903, and employs seventy-five hands. Col. George R. Wallace, is president, Frederick Wallace, secretary, and M. F. Dunn, treasurer, of the corporation.

In 1920, Walter S. Hall invented a new type of bronze screen plate, for use in pulp and paper mills, and that year formed the Fitchburg Screen Plate Company, which is capitalized for \$50,000.

THE BROWN BAG FILLING MACHINE COMPANY

Fitchburg has been noted for unique inventions and products. It was on Academy Street, on June 16, 1863, that the first of the Butterick patterns, now sold throughout the world, were cut, and the city is the home of one of the most ingenious inventions of recent years, the Brown Bag Filling Machine, which the United States Government has used for years in preparing the almost endless number of bags of government seeds forwarded to the constituents of Senators and Congressmen from the Atlantic to the Pacific.

The Messrs. Brown were creators of numerous machines almost uncanny in their operation, and became renowned for their bag making, envelope, and other automatic machines for encasing dry materials, seeds, powders, pills, tablets, nails and screws in counts, seed packets, and screw machine products, in flat packets. The concern today employs 100 operatives. F. N. Dillon is president, E. G. Loomis, vice president, and Perry I. Wilson, treasurer and secretary.

The motor industry is represented by the Netec and Wachusett trucks, the New England Truck Company manufacturing the former type and employing sixty operatives, and the Wachusett Motors, Inc., capitalized for \$100,000, employing thirty hands, in the production of the Wachusett motor trucks. The board of directors of the New England Truck Company, are Messrs. E. V. and M. A. Welch, J. F. Perault, E. J. Breen, and J. J. Hogan. F. H. Suthergreen is president and treasurer, and C. D. Sheehan, secretary of Wachusett Motors, Inc.

Two plants of the American Woolen Company—the Arden and Beoli Mills—are located in the city, and their production adds materially to the local textile output. The Arden plant is equipped with 168 looms and the Beoli unit, with eighteen sets of machinery, 6,216 spindles, and 150 looms.

The S. G. Cushing & Son Company, owned by R. W. Cushing, which specializes in wood-turning, employs twenty-five operatives; the Fitchburg Grinding Machine Corporation, capitalized for \$160,000, with A. L. Goodnow as president, W. L. Mason, vice president, and Robert D. Gould, treasurer and secretary and manufacturing a unique modern type of patented grinding machinery, the market for which has enabled the concern to build up a business requiring the steady employment of 100 mechanics; the Webber Lumber & Supply Company, capitalized for \$100,000 and employing 100 in its wholesale lumber operations with E. M. Cookman as president and R. R. Cookman as treasurer and secretary; the L. H. Goodnow Foundry Company, of which A. L. Goodnow is president and treasurer, and A. P. Goodnow, secretary, employing sixty operatives in the manufacture of grey iron castings and the Independent Lock Company capitalized for \$75,000, which recently removed to the city from Leominster, and which, in 1928, built a two story addition to its local plant, affording capacity for 300 employees in lieu of the original 100 workers engaged in the manufacture of locks and keys, and of which Morris Falk is president and treasurer, and J. Ward Healey, secretary, constitute some of Fitchburg's other live-wire concerns.

The manufacturers of the city are fortunate in having available for industrial production the up-to-date facilities provided by the Fitchburg Gas & Electric Company, a part of the Tenney interests, capitalized at \$2,468,600, and locally employing 200 hands, in the production and distribution of gas and electric power, this corporation being the city's second largest taxpayer, its local properties being assessed for \$3,402,400, in 1928.

Fitchburg has been favored in having substantially all of its larger industries locally owned, and profits received from long-established units have been used to develop new concerns.

In 1928, the plant of the Orswell Mills, built in 1886, was purchased by Raleigh F. Mazze and Benjamin L. Sharff, of Boston, who are now utilizing 75,000 square feet of the area, in the manufacture of reed and

fibre furniture, while the balance of the space has been leased to small manufacturers. Mazze-Sharff, Inc., has capital of \$100,000 and employs 150 hands. Raleigh F. Mazze is president, Rudolf P. Berle is secretary, and Benjamin L. Sharff is vice president and treasurer.

LIKLY BAGGAGE, INC.

The largest local industrial transfer of recent years was the sale of Parkhill Mill "C" to Likly Baggage, Inc., of Rochester, N. Y., in August, 1928, which concern, with associated industries, has taken over all the 450,000 square feet in the plant, and is employing from 250 to 400 hands, the latter figure being reached in the peak seasons.

Likly Luggage, Inc., was organized to take over the trade name, goodwill, patents, machinery, dealers and customers of Henry Likly & Company, makers of Likly Luggage, which company has been in continuous business since 1844.

An analysis of the reasons which prompted this octogenarian manufacturing concern to remove from the Empire State to Massachusetts is interesting and gives a very fair commentary on conditions.

John A. Williams, vice president of the company, pointed out the major factors which controlled the action to be:

1. Because Boston is the greatest market in heavy leathers in the world, and leather is the largest single item of purchase by the company.
2. In excess of 95% of all the locks used in trunks, bags, and suit cases are made in New England.
3. At least 80 per cent of bag and suit case frames are produced in this section.
4. Practically all of the trunk hardware used by the company originated in New England.
5. The printed cotton linings and imitation leathers used by the concern are manufactured in Massachusetts, or New England.
6. The rivets, nails, sundry supplies, Pyroxlin fittings, etc., that are required are produced within easy trucking distance of Fitchburg.
7. The greater part of the machinery used, which is similar to that employed in the shoe industry and the leather trades, has its origin in Boston, Beverly, or cities and towns near Fitchburg, particularly sewing and riveting machines.
8. The sales record of the concern indicated that 72% of the market for better grade luggage is located on the eastern seaboard, or within a 500-mile radius of the Fitchburg plant, with the most important markets in New York, Boston, Philadelphia, and the large eastern cities.
9. New England consumes approximately 10% of the total luggage produced in the United States, with a large percentage of better grade merchandise sold here than is maintained in some other localities.
10. Factory laws were found, as a whole, to be fair and not arbitrary.
11. Shipping facilities at Fitchburg were better than in most communities, especially foreign shipments, and the west coast trade which the company routes via the Panama Canal.
12. Power costs were found to be extremely favorable, when compared with other communities investigated.
13. Taxation percentages were lower than in other sections of the country.

14. No extreme conditions in weather were likely to affect manual labor in the manner contended with in the South.

15. The R. G. Dun reports for 1926 and 1927 showed no bank failures in these years in New England—the only division zoned by the Dun agency that did not have all the way from three to 1,926 in the same years.

16. The R. G. Dun insolvency records showed the total number of commercial failures in 1927 in the six New England states were 2,465, with total liabilities of but \$55,000,000, while in the same years New York state, with a manufacturing population not in excess of that in New England, reported 3,248 insolvencies, totaling \$98,000,000—almost double the New England figure, and the South Atlantic states, with a manufacturing population much less than that of this section reported liabilities of \$67,000,000.

17. The Parkhill plant was modern, peculiarly adapted to the needs of Likly Luggage, and with sufficient area to provide for the greater expansion program contemplated by the company.

18. The community spirit existing in groups of Fitchburg business men impressed the company's executives.

19. Following exhaustive investigations covering many states, Mr. Williams declared the company's executives became convinced that a New England location presented the most in natural advantages of any section in the country.

In the first analysis, what seemed to be a calamity, when Parkhill Mills A, B and C, and the Orswell Mills were thrown on the market has proved to be a blessing in disguise, as the former industries were manufacturing products that were not readily salable at a profit. Their closing made available a large amount of space that could be purchased or leased, by other industries, at attractive prices, and thus diversify the manufacturing production of Fitchburg.

J. Woolf Tietel is president, John A. Williams, vice president, William A. Zimmerman, treasurer and R. F. Dunphey, secretary of Likly Luggage, Inc.

In 1928 the Holland-Kenyon Machine Company, which was formed seven years before erected a one-story brick and steel building 32 by 46 feet, where replacement parts for automobiles are manufactured and cylinder grinding and general machine work carried on.

The business is owned by John W. Holland and Samuel R. Kenyon.

The same year the plant of the Safety Vision Company was removed from Ayer to Fitchburg, occupying two floors and employing when in full operation 150 workers.

The Angel Novelty Company, a partnership consisting of Frank M. Angel and Alphonse Angel, greatly expanded its facilities in 1928. The concern has capital of \$75,000, and employs fifty operatives in producing interior house finish.

The same year the Fitchburg Auto-Electric Company manufacturers of replacement parts for motor cars, radios, and other electrical products, erected a one-story factory.

The Winchester Sportwear Company, of which Charles Resnick is president, removed to Fitchburg, in 1928, from Winchendon, and is operating at full capacity. I. Lazerowich is vice president, and Elizabeth Tish, is treasurer.

In 1928 the Fitchburg Veneer Products Corporation was incorporated

and took over the business of the Medford Plywood Corporation. The firm occupies 50,000 square feet of space and employs 100 workmen. Herman Davis is president, Jerome Davis, vice president, and John A. Williams, treasurer.

Among other present-day industries are the Auto-Mailing Machinery Company with capital of \$200,000, employing twenty-five, in the production of mailing machines; O. S. Cook & Sons Company, with capital of \$50,000, employing thirty-five in the manufacture of wooden boxes and shooks, Ornan S. Cook being president, Cassius M. Cook, secretary, and Ornan S. Cook, Jr., treasurer; the Fitchburg Foundry Company employing sixty, in the production of metals and owned by Joseph F. Perault; the McCauliff Quarry Company, Inc., employing sixty in the quarrying of granite; and the New England Curtain Company capitalized at \$99,000, employing 100, in the manufacture of curtains and draperies, this concern having built a two-story addition to its plant, in 1928, permitting of the employment of sixty more workers. William F. Matthews is president and George T. Adams is treasurer and secretary.

Other local concerns are: A. J. Asher & Sons, a partnership made up of A. J. and Benjamin Asher, employs seventy-five operatives in the manufacture of trousers; the L. E. Bergeron Paper Box Company, owned by Messrs. L. E., N. C., and G. L. Bergeron produces paper boxes; the J. Cushing Company, with capital of \$600,000, produces animal feeds and grain, Milton L. Cushing being president and treasurer, and Frank G. Peterson, secretary; the Fitchburg Manufacturing Company, employs thirty hands in the manufacture of lacquered novelties, W. G. Walker being president, C. F. Peirce, secretary, and L. F. Sawyer, treasurer.

Approximately ninety years ago (1837) the four cotton mills, three woolen mills, two paper plants and two scythe factories, produced commodities valued at \$380,200.

Illustrating the efficiency of the industrial workers of Fitchburg 7,948 wage earners produced commodities in 1927 which sold for \$46,710,242, while 8,004, in 1921, manufactured goods valued at but \$40,785,312.

In 1927, the total value of all products manufactured in the 103 establishments, in Fitchburg, was \$46,710,242, an increase in the seven year period from 1921, of \$5,924,930.

The value of stock and materials used in 1927 was \$26,367,913, the average number employed being 7,948, and the amount paid in wages being \$9,669,223.

The paper production of the city accounted for \$17,586,873, of the total value of all manufactures, in 1927, as against a total value of \$12,818,067, in 1921, or an increase in the seven year period, of \$4,768,806.

CHAPTER LIV
LEOMINSTER
A SHINING EXAMPLE OF THE VERSATILITY OF BAY
STATE MANUFACTURERS

THE SCENE OF A ROMANTIC TRANSFORMATION FROM HORNS AND HOOFES
TO PYROXYLIN PLASTICS

The city of Leominster would serve as another outstanding example of a municipality that has gone wrong were we to believe the canards so industriously circulated via subterranean and other channels by those who would have the world believe that Massachusetts is industrially anaemic and dying of general lassitude.

In 1837—about ninety years ago—Leominster was described as “a pleasant town, containing much land,” and while today there are still excellent agricultural possibilities in the outlying areas of the city, nobody thinks of the municipality as a farming community. In 1837, agriculture dominated, the output of farms that year being valued at \$80,800, and even as late as 1845, the total stood at \$77,400.

A mill, where paper was made by hand, was established in North Leominster, in 1796, which is said by some authorities to have been the first paper plant set up in Worcester County, and one of the earliest establishments of its kind in the country.

Hon. Alvah Crocker, of Fitchburg, one of that city's industrial leaders, was born in a house adjacent to this mill, the dwelling still standing at the present day.

While the town had the usual number of small saw and grist mills in the early days, the excellent water power attracted the attention of paper manufacturers and as early as 1858 the senior George W. Wheelwright, of Boston, leased a two-machine plant on the Nashua River, at North Leominster, where news print paper was produced for the Boston *Herald* and *Journal*, and the New Orleans *Picayune*.

Seven years later Mr. Wheelwright bought the property for \$70,000. George W. Wheelwright, the second of that name, further developed the plant, with the able assistance of Henry T. Page. In 1880 the company began the manufacture of Bristol Boards, being the first concern in the United States to produce that line of paper.

The third George W. Wheelwright is now president of the George W. Wheelwright Paper Company, and under his able management production has grown to thirty-five tons per day of Bristols, Index and Blanks, under the brand of “Dove Mill,” which was the watermark of the old hand-made paper product established 134 years ago. The company also operates another plant at Wheelwright, in Hardwick, which turns out daily twenty-five tons of high-grade book paper. The corporation has capital of \$500,000 and employs 250 operatives. George W. Wheelwright is president, H. M. Wheelwright, vice president and secretary, and E. B. Dik, treasurer.

THE BEGINNINGS OF THE COMB INDUSTRY

Obadiah Hills appears to have been the first maker of combs in Leominster, and about 1770 he fabricated these commodities from cows' horns, by hand, in the kitchen of his home. As early as 1793 twenty persons were turning out about 6,000 dozens of horn, ivory and shell combs per year. Jonathan Johnson, employing five men, produced 2,500 dozen yearly. Ivory combs of excellent quality were made by one local manufacturer at that period.

Gradually machinery was invented locally which ultimately superseded the slow, tedious and crude hand operations, and many inventions flowed from the brains of Leominster's comb-makers.

On May 21, 1814, Joseph H. Derby was granted a patent for cutting combs at a single operation. The first screw-press introduced was installed in Silas Hills' shop, being patented by McPherson Smith, in 1818. John Buzzell was the first producer of labor-saving tools used in the comb industry, and he designed and invented scores, while Jonas Colburn was the first to use cotton cloth-balls for polishing. Ward M. Cotton invented the automatic machine, with cams, for cutting combs.

The rise of the Viscoloid Company is a story of twentieth century industrial romance and marks the beginning of a complete change in the raw material from which combs and allied products were formerly fashioned. Today, almost all the concerns in Leominster that relied upon horns and hoofs for raw materials have changed their production to conform with the more economical and artistic pyroxylin products, and more than thirty local concerns virtually control the market for novelties in these lines.

LEOMINSTER'S BIGGEST CONCERN WAS BORN THIS CENTURY

The coming of the powerful du Pont interests to Leominster; the amalgamation of the prosperous Viscoloid Company of that city with this progressive group of manufacturers, and the greatly increased floor space for manufacturing purposes since added by the consolidated corporation is indicative of the fact that these New York and Delaware capitalists, who are supreme in many fields of industrial effort, scarcely look upon Massachusetts as sterile industrial ground.

Not only do the Viscoloid Works hold the foremost rank in their field, but their growth, since their founding in 1901, constitutes one of the most remarkable manufacturing developments of this century. In less than three decades, the company has developed from an unpretentious beginning, with its manufacturing processes scattered among four small buildings, to a plant which comprises some seventy odd structures, covering more than forty acres of ground, and affording employment to more than 2,000 men and women.

Formed for the purpose of manufacturing a product known as Viscoloid sheeting, which comprises a pyroxylin plastic material now generally employed in the comb industry, and in other lines, the channel into which the commodity entered naturally suggested the use of the article by the Viscoloid interests, and, in 1902, Alexander S. Paton, Bernard W. Doyle, and Ludwig Stross, organized the Sterling Comb Company for the manufacture of dressing combs, hair ornaments, and other products, fashioned from viscoloid sheeting. Two years later, the plant of the comb



THE VISCOLOID WORKS OF THE DUPONT VISCOLOID COMPANY, INC., LEOMINSTER
INSERT, THE ORIGINAL PLANT OF THE VISCOLOID COMPANY

unit was burned to the ground, but within four months a new building was erected. In 1906 the Harvard Novelty Company was formed by the same officers, and engaged in the production of mounted combs, brushes, mirrors, toilet articles, and novelties.

Appreciating the value of concentration and specialization, Messrs. Paton, Doyle and Stross, in 1912, merged The Viscoloid Company, the Sterling Comb Company, the Harvard Novelty Company and the Paton Manufacturing Company which was founded in 1879, into The Viscoloid Company and it soon achieved a leading position in its field of production.

In 1923, Mr. Paton, its first president, retired, and Mr. Doyle became president and general manager. The du Ponts becoming interested in the progress of the concern made overtures to merge it in its enterprise and Mr. Doyle became vice president of the du Pont Viscoloid Company, Inc., capitalized at \$15,000,000.

Within recent years many new buildings have been erected and long since the concern took rank as Leominster's largest industry.

IMPORTANCE OF THE CITY IN THE PIANO CASE INDUSTRY

Sixty-five per cent of all the piano cases manufactured in the United States are turned out in Leominster, the industry having its rise in 1845, when J. C. Lane began the business. In 1851, John H. Lockey bought the plant erected by Lane four years before, the latter having built a new factory, on the opposite bank of Monoosnock Brook. The John H. Lockey Piano Case Company was subsequently formed and operated until 1915.

In 1891 Everett B. Richardson, L. L. Richardson, Henry R. Smith and Charles J. Cobleigh incorporated the Richardson Piano Case Company which now utilizes over 150,000 square feet of manufacturing space in the manufacture of piano cases, the plant being the largest in its line in the country. The advent of the radio has opened a new line of production, and elaborate cases are now being turned out by its artisans for some of the largest radio manufacturers in the country. Capitalized for \$300,000, the company employs 300 operatives. Everett B. Richardson is president and Rolfe Smith, treasurer.

In 1895, Frank E. Wellington, and others, incorporated the Wellington Piano Case Company and seven years later greatly enlarged the plant. The company, capitalized for \$500,000, turns out upwards of 12,000 upright and grand piano cases annually, utilizing 2,000,000 feet of lumber each year, and employs 150 operatives. C. F. Wellington is president and C. A. Jacob, treasurer.

The pioneer paper box manufacturer of Leominster was Mrs. Elvira F. Dodge, who, in 1857, with capital of \$20 began the business which she continued for forty years. In 1890, the firm of E. F. Dodge & Co., was formed, and in 1908, the E. F. Dodge Paper Box Company was incorporated. The concern has capital of \$36,000 and employs upwards of fifty operatives. F. W. Phillips is president, B. F. Phillips, treasurer and B. L. Stowell, secretary.

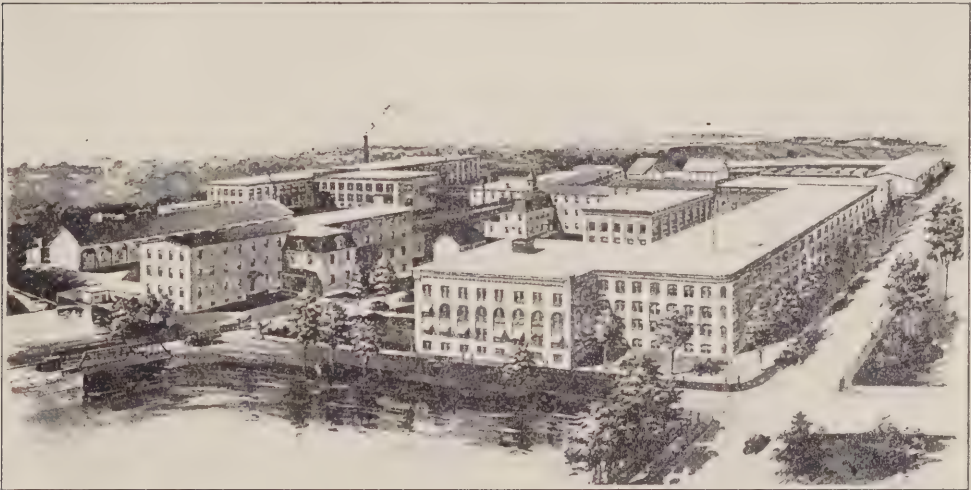
THE ADVENT OF THE BABY-CARRIAGE INDUSTRY

One day, in 1858, while F. W. Whitney, of Leominster, was in Greenfield, he chanced to be attracted by a locally built baby carriage, and returning home he discussed, with a younger cousin, the probable success of a baby-carriage factory, in Leominster, with the result that they

hired the basement of the old Lockey shop—a building hitherto devoted to the manufacture of apple parers and corn plasters,—where, under the firm name of F. W. and F. A. Whitney, they began business, that year. Seventy-five two-wheeled carriages were turned out the first year, some of which were taken to Boston, where F. A. Whitney, in a crude attempt to advertise, wheeled them about the streets.

In 1862 fire destroyed the building in which they were located, only a planer being saved from the wreck. They carried no insurance, and only by borrowing from friends were they able to resume business. In 1865, F. A. Whitney purchased his cousin's share in the firm, bought land on Monoosnock Brook, and erected a two and a half story wooden factory, 60 by 30 feet.

Five years later, F. W. Whitney, with his brother, William, and Sumner M. Frost, a brother-in-law, re-entered the baby-carriage manufacturing business and built a factory adjoining the F. A. Whitney concern, but



F. A. WHITNEY CARRIAGE COMPANY, LEOMINSTER

the following year the latter induced the new group to join with him, and the F. A. Whitney Carriage Company was incorporated. For seven or eight years thereafter, the concern manufactured carts, as well as baby carriages. F. A. Whitney purchased at the Centennial Exposition at Philadelphia, in 1876, the first turbine wheel with a draft tube, exhibited by the Holyoke Machine Company, its maker, and installed it on his water-power privilege.

In 1900 the production of doll carriages was added, the concern being the first company in the United States to manufacture such commodities and today thirty-five different types are made at the Leominster plant.

By 1888 production of baby carriages reached 35,000 a year. Almost countless inventions have been made in the years since the company was formed, one of the most important being that of F. J. Shaw, who, in 1904, while a member of the firm, conceived the idea of providing a substitute for reeds through the medium of twisted paper, pregnated with glue sizing. The use of this fiber became important in the baby carriage

and furniture trades, and it is now woven on looms made expressly for the purpose by the Whitney concern.

When the fibre was first patented, little attention was given this new raw material, but the impossibility of securing German reeds during the World War brought it into great prominence, and today 75% of the present production at the Leominster plant consists of fibre carriages, which have almost completely superseded the equally large reed production of ten or more years ago. It was early found that fibre lasts many years if properly protected, whereas reed eventually grows brittle. Thus a contribution was made to American industry by Mr. Shaw that has proven an inestimable boon to the baby carriage and furniture trades.

F. A. Whitney retired from the corporation in 1898, to assume the active management of the Wachusett Shirt Company, and was succeeded by Joseph P. Holman, as president, who entered the employ of the concern when he was eighteen years of age. Since 1920, his son, William E. Holman, vice president of the corporation has been president. B. H. Hayes is vice president, Paul R. Holman, secretary, and K. M. Walters, treasurer.

The company's products are sold in every state in the Union, and throughout Canada. The corporation has capital of \$84,000 and employs 650 operatives.

From the single unit of 1858 the plant has grown until it occupies twenty-nine buildings located on twelve acres of ground, but so admirable is the layout, and so efficiently are the machines arranged, that the raw materials—wood, reed, iron and steel—come in at one point, complete a circle and come out a completed carriage.

LEOMINSTER'S DIVERSIFIED INDUSTRIES

In 1861, Wade H. Jewett, who had come to Leominster five years before and had been employed in Gove & Howard's piano-case factory, formed a partnership with George A. Allen, and began the manufacture of pianos, as well as cases, the firm of W. H. Jewett & Co., being established, in 1870, by Mr. Jewett, and R. B. Richardson, of Woburn. In 1885, two of Mr. Jewett's sons, and a nephew, F. J. Woodbury, succeeded to the business, and formed the Jewett Piano Company, which, in 1891, was acquired by M. Steinert & Sons, of Boston, but the manufacture of the Jewett, Woodbury Curtis and Berkshire pianos is carried on in the Leominster plant by 200 employees.

W. P. Haines & Co., Inc., is also engaged in the local manufacture of pianos, employing sixty operatives. T. L. Floyd Jones is president, Charles T. Carter, vice president and treasurer, and T. L. Floyd Jones, Jr., secretary.

In 1864, Samuel Merriam, George Hall, and S. C. Pickard, formed the partnership of Merriam, Hall & Co., and began the manufacture of chamber furniture, at North Leominster, and today operates two factories there, in which 100 operatives are employed. A. H. Hall is president, E. E. Whittier, vice president, A. J. Hall, treasurer, and R. A. Joslin, secretary.

Michael Damon, founder of the present Damon Company, invented the swing-jaw comb cutting machine. In 1865, his son, George R. Damon, became a member of the firm of Damon & Son, and in 1869 the firm of Look, Damon & Co., was organized, being succeeded, from 1881 to 1901, by Damon, Howe & Co. In the latter year the Damon Company was

incorporated by George R. Damon, and his three sons, Russell H., Ralph E. and Murray C., the latter now being the president and treasurer of the concern, which employs 125 operatives in the manufacture of celluloid novelties and horn buttons.

In 1865, S. S. and Frank T. Crocker, and Solon Perry erected a four-set woolen mill, which was bought by Edward M. Rockwell, in 1876, who, in 1887, changed the production to woolen yarns, and during the next ten years, expanded the equipment to fifteen sets. In 1910 the concern was incorporated as the Rockwell Woolen Company, with capital of \$50,000, and now employs eighty hands in producing woolen and merino yarns, for the weaving and knitting trades. Charles B. Smith is president and A. C. Rockwell, secretary and treasurer.

In 1869 the B. F. Blodgett Company was organized to manufacture horn hair ornaments and knife handles, but celluloid has supplanted horn in all its products, save knife handles, and the concern now employs seventy-five hands, and has capital of \$70,000. Mark L. O'Toole is president and treasurer.

The year 1869 also saw the birth of the Goodhue Company, which manufactures horn handles, and whose officers are N. V. Goodhue, president, and Joseph A. Goodhue, treasurer and secretary.

In 1870 William D. Earl, a native of Attleboro, removed to Leominster, where he organized the firm of W. D. Earl & Co., and began the manufacture of horn combs and buttons, which he continued for forty-one years, being associated with his brother, Thomas A. Earl, from 1870 to 1899, when the latter retired. The concern now specializes in celluloid goods and novelties, and employs fifty hands. C. H. Trowbridge is president, C. F. Fiske, vice president, and William B. Earl, treasurer.

LOCAL INDUSTRIES ESTABLISHED IN THE '80S

The Wachusett Shirt Company was founded in 1882, and incorporated three years later, erecting, in 1885, a brick factory, with capacity of from 600 to 800 dozen dress shirts daily, probably the largest in the country at that period. Later, two additional factories were built. The company has capital of \$1,000,000 and now employs 300 operatives. George P. Jones is president, William E. Holman, vice president, William H. Cropper, treasurer, and Albert R. Hess, assistant treasurer.

In 1883 C. H. Tenney and Charles H. Porter formed the horn goods concern of Tenney & Porter, later changing to celluloid novelties, and employs from 50 to 75 operatives. In 1914 George A. Porter became the sole owner of the company, and is president and treasurer of the corporation.

William Rodger founded the Leominster Worsted Company in 1886, and in 1891, the concern was incorporated under that name. The plant is equipped with 102 looms and the company is capitalized for \$174,000. It employs 175 operatives in producing worsted and woolen fabrics for men's wear. Howard H. Chase is president and treasurer, and Alfred N. Litch, assistant treasurer.

In 1887 the Valpey & Anthony Shoe Company of Lynn erected a four-story and basement factory in Leominster as an auxiliary plant, employing 110 workers at one period.

In 1889 J. W. Pickering and W. J. Metcalf formed the partnership of Pickering & Metcalf, which continued until 1912, when the senior

member acquired Mr. Metcalf's interest and organized J. W. Pickering & Co., which produces hair ornaments and celluloid novelties, employing 125 hands. In 1906 Mr. Pickering bought the wood-turning and enameling enterprise founded by Wilbur N. Maynard, in 1880. J. W. Pickering is the sole owner of J. W. Pickering & Co.

REED, SHIRT AND COMB COMPANIES

In 1893 the Whitney Reed Chair Company organized to manufacture reed furniture and doll and baby carriages, acquired the H. M. Richardson Company, producers of hobby-horses, and, later the W. S. Reed Company specializing in novelty toys, and, in 1913, the concern was incorporated as the Whitney Reed Corporation. Capitalized for \$100,000, the concern employs 125 operatives in the manufacture of reed chairs, doll carriages, and hobby-horses. A. A. Tisdale, the president of the corporation, also operates the Horn & Supply Company, which he organized and owns. W. H. Howe is secretary and treasurer of the Whitney Reed Corporation.

In 1899 Cluett, Peabody & Co., of Troy, N. Y., purchased the machinery and fixtures of the Leominster Shirt Company, and two years later, requiring additional space, moved to the factory owned and formerly occupied by the G. A. Gane Shirt Company. In 1913 the plant built and occupied by the E. B. Kingman Company was purchased, and utilized in addition to the Gane factory. The next year the concern began manufacturing paper boxes locally for use in packing the local products, and employs 600 operatives in its several Leominster units.

In 1900 Warren H. Goodale organized the Columbia Comb Company, but within a year thereafter the concern lost its factory through fire, and, in 1904, Mr. Goodale formed the Goodale Comb Company and engaged in the manufacture of celluloid hairpins and combs, the concern employing seventy hands.

The Howe Comb Company was incorporated in 1903 by Charles A. Howe and George A. Marshall, and specializes in celluloid novelties and horn hairpins. It turned out during the period of the World War millions of buttons. The company employs seventy-five hands.

ANOTHER TWENTIETH CENTURY INDUSTRY

In 1906 J. Philip Legere and William H. Lane founded the Standard Comb Company, starting with 640 square feet of floor space, which, in less than a quarter of a century has grown to more than 100,000 square feet, again demonstrating that Massachusetts has witnessed the inception of new concerns in this century that have grown from little acorns to giant oaks. In 1924 the three plants of the company, then being operated, were combined in one manufacturing unit, and reincorporated under the name of the Standard Pyroxoloid Corporation, with total capital of \$800,000, and, today, the plant consists of more than thirty factory structures on Nile Street, where sheet and rod pyroxylin products are manufactured, while the finished commodities are fabricated in the Pleasant Street and the Mechanic Street units. There are but five companies in the United States engaged in the production of raw celluloid in sheet and rod form, and the Standard concern stands second to the Viscoloid Works, in its total annual production of these commodities.

William H. Lane is president and treasurer, Patrick J. Moore, vice president, and J. Edmund Cooper, secretary of the corporation, which today employs 500 operatives, compared with a dozen less than twenty-five years ago. It has capital of \$797,461.

SOME LOCAL TWENTIETH CENTURY CONCERNS

In 1911 Lionel B. Kavanagh and F. A. Adams organized the concern today known as the Standard Tool Company, specializing in machinery used in the manufacture of celluloid articles, and later absorbing the Stowell Company, the Frank A. Cook Company, and the old Standard Tool Company. From 400 square feet the manufacturing space has grown to upwards of 12,000 square feet, and in 1913 Mr. Kavanagh became the sole owner. The concern employs upwards of fifty men.

M. J. Farrell and John Hyland established the firm of Farrell & Hyland in 1912, which now employ seventy-five hands in the manufacture of hair ornaments and ivory novelties.

M. J. Farrell is now the sole owner.

In 1914 Edward H. Saxton bought a controlling interest in the Leominster Shell Goods Manufacturing Company and shortly afterwards incorporated the business. Ten years later, the corporation acquired the assets of the Yale Novelty Company of Leominster, and 175 hands are employed in the manufacture of celluloid and horn goods, the concern maintaining sales offices in New York and Boston. The corporation has capital of \$200,000. E. H. Saxton is president and treasurer, and N. H. Farr, secretary.

In 1914 John W. Maxim and Lloyd H. Maxim established the Leominster Paper Box Company, which employs forty operatives in the manufacture of stiff paper boxes.

Edward B. Kingman, Charles H. Thomas, C. and Harry P. Howe, formed the E. B. Kingman Company in 1914, and established a factory, on Monoosnock Brook, where eighty-five operatives are today engaged in manufacturing celluloid goods, pins and novelties. Thomas C. Howe is president, Harry P. Howe, secretary, and Charles H. Howe, treasurer.

The New England Novelty Company succeeded the Bay State Comb Company, which was established by A. L. Preston. The company was reorganized in 1918, and now employs thirty operatives. Louis Levine is president, and Joseph Levine, treasurer.

In 1918 the Pyrotex Leather Company was formed by Harold W. Burdett, and others, to manufacture a leather product, which is the outcome of scientific developments in the celluloid industry. It has capital of \$75,000. Winthrop M. Mayo is president, and Harold W. Burdett, treasurer.

WHITNEY & CO. KEEPS UP WITH THE TIMES

Whitney & Co., established by Walter F. and Fred A. Whitney, employ seventy-five hands in the manufacture of paper boxes, specializing in many varieties. Walter F. Whitney is president and Fred A. Whitney, treasurer.

With forty years of experience behind it, the concern today occupies a group of buildings, containing three acres of manufacturing space, equipped with modern machinery for producing folding boxes, display stands and fancy set-up boxes for confectionery, and doing a national

business which extends from coast to coast. The company is one of the outstanding Massachusetts units that has built its selling policy on the idea that the appeal of a package plays a vital part in merchandising products. The concern also owns and operates the Handifold Toilet Paper Company.

SOME OTHER PROMINENT INDUSTRIES

The Royal Comb Company, capitalized for \$110,000, is one of the city's growing industries, now employing 150 operatives in the manufacture of celluloid novelties and hair ornaments, and maintaining a New York office at 101 West Thirty-first Street. Frank L. Brigham is president, Crofton C. Holdem, treasurer, and G. A. Webber, clerk of the corporation.

The Star Manufacturing Company was established by Peter McKenna, about twenty years ago, for the manufacture of celluloid hair ornaments, and fifty or more hands are employed. Peter McKenna is president and treasurer, and the corporation has capital of \$50,000.

The Tilton & Cook Company takes rank as one of the larger enterprises of the city, engaged in the production of celluloid goods, combs and novelties, being capitalized for \$200,000, and employing upwards of 200 operatives. Marvin W. Sherwin is president, Frederick H. Cook, secretary, and Horace F. Cook, treasurer of the corporation.

In 1928 Zonis Brothers Company, manufacturers of trousers, removed their operations from New York City to one of the vacant floors of the Wachusett Shirt Company's plant, but finding more space necessary it later occupied a factory on Manning Avenue.

In 1929 the E. W. Higgins Company was formed by E. W. Higgins, formerly assistant manager of the Hopewell-Du Pont Works, Inc., of Hopewell, W. E. Tanner, formerly superintendent of the Pickering Company and Donald S. Gordon, and deal in pyroxylin products, sheeting rods, cements, and polishes.

Included in Leominster's industrial enterprises, organized during the present century, are the American Novelty Company, C. Arlington Barnes, the Castle Button Company, the Cellu-Products Company, Foster-Grant Company, Inc., Grimes & Harris, the High Grade Manufacturing Company, Model Comb Company, George Morrell, Inc., and Superior Comb Company, employing in the aggregate 450 employees, and manufacturing celluloid goods and novelties; the W. A. Fuller Lumber Company, specializing in cabinet work; the Dowd-Ivoroyd Novelty Company, manufacturing ivory novelties; Lambert & Latimer, engaged in wood-working, employing forty; the Leominster Novelty Corporation, manufacturing display fixtures, employing forty, and Haldie Nicholson, engaged in enamelling and employing forty operatives.

The United Comb Novelty Company employs sixty operatives in the production of celluloid combs and novelties. Theodore Tourigy, Sr., is president, Theodore Tourigy, Jr., treasurer, and Eugene L. Tourigy, secretary.

The Wood Novelty Company, Inc., manufactures children's furniture and toys, and employs fifty hands. J. P. Mercier is president, and D. F. Maloney, treasurer and secretary.

Numerous small manufacturers, employing under twenty operatives, are also engaged in various types of production.

Early in 1929 the Pyrotex Leather Company acquired the American

manufacturing rights of the Sevigie-Pearl Laboratories et Cie and erected a factory for manufacturing the product of this company. The product is coated paper with crystal and opalescent finishes, and is used in the manufacture of high-grade boxes for confectionery, perfume and stationery.

In 1929 the Miles Kedex Company, of Lancaster, owned by C. C. Miles, manufacturers of the patented "Kedex" indexed key cases and for two years past makers of art leatherette and leather picture frames, which have met with a large sale all over the country, found it necessary to expand and move its business into larger factory space and to install new and improved machinery. The firm leased manufacturing and office space in the factory of Whitney & Company and removed from Lancaster, in June, 1929.

THE LATEST STATISTICS OF LEOMINSTER'S MANUFACTURES

The eighty-one manufacturing industries operating in Leominster, in 1927, represented a total capital investment of \$18,430,986. They used that year stock and raw materials valued at \$10,084,828, and produced commodities valued at \$21,057,165. These factories employed in 1927, 5,058 wage earners, to whom were paid in wages \$5,392,198.

The principal products manufactured in Leominster in 1927 were combs and hairpins and fancy articles made of celluloid, and the total value of these products (\$6,802,030) constituted 32.3 per cent of the total value of all products manufactured in the city during that year. Other important products were: Shirts, children's carriages and sleds, musical instruments and materials, chemicals and woolen goods.

CHAPTER LV

GARDNER

THE CHAIR TOWN OF THE UNIVERSE

Gardner is a chair city by heritage, the industry having been predominant for a century and a quarter, and chair craftsmanship having been followed in certain families for four and five generations.

It is the American center of the chair-making trade and every device necessary to meet world demands has been thought out and wrought by the artisans of the industry until the municipality stands first in the entire world and takes pride in its international reputation of being the chair city of the universe.

This enviable honor has been won partly through the vision, stability and enterprise of those identified with the industry, and partly through the fortunes of war, for it was not until after the recent world struggle that Gardner was able to wrest from an Austrian town the honor of being the largest producer of chairs in the world. The crippling of industry in Central Europe resulted in the passing of the crown from abroad to the United States, and since the inception of the Gardner concerns, whose exclusive product is chairs its artisans have manufactured more than \$100,000,000 worth, and as many as 4,000,000 chairs in a single calendar year, with a selling value of \$12,000,000.

Today it is estimated that the total yearly value of chairs produced in Gardner is \$20,000,000. Gardner stands as another example of an agricultural community emerging into an industrial town and city, despite the fact that from the geographical standpoint it was isolated for many years from the rest of the Commonwealth until the coming of the railroads, while it lacked any considerable waterpowers such as were possessed by other Worcester County towns, whose terrains were located on sizable rivers.

For fifty years following its settlement farming was the main occupation of its citizens, with now and then an occasional blacksmith, shoemaker or tanner following his trade. A few coopers appeared in the early decades of the nineteenth century and engaged in the manufacture of pails, barrels, and other wooden ware articles, and the surplus timber supply was converted into potash. Tanneries, a sawmill, a nail manufactory, a fulling and carding mill and a factory where pine furniture, toilet tables and wash stands were manufactured, comprised Gardner's early principal industries.

Chair making had its beginning in the enterprise of James M. Comee who, in 1805, in one of the rooms of his dwelling house, located on what is known as *Pearl Street*, began the manufacture of chairs, which with the exception of the legs, turned by a lathe, were made by hand. The chairs were provided with wooden seats. Later, Comee produced

"flag" seated chairs, which were followed by those with rattan bottoms. The products were sold from house to house in Worcester, Lowell, Springfield and other places.

Comee employed several men as apprentices, including Isaac Jaquith, Enoch and Elijah Putnam, Luke Fairbank, Joseph Jackson and Artemas Brown, many of whom later entered into the manufacture of chairs on their own responsibility.

With no circular saws available, the early chairmakers used hand axes to cut the stock for turning and the corners of the sticks were cut off as it was supposed they could not be turned square. Foot power, a windmill, horse-power, a treadmill, and later water-power were employed, Elijah Putnam, one of Comee's apprentices, who opened a chair shop about 1825, first using the water-mill privilege now the property of the John A. Dunn Company. He introduced the first cane seat, a chair thus equipped made in the Connecticut State Prison, being brought to Gardner by one of his employees, in 1832 or 1833, and after fashioning the seat with holes bored for the cane the products were sent around to families far and near "to be seated."

Associated with each of the varied industries that have made Massachusetts a great manufacturing center there is frequently a single name, the mention of which immediately suggests a specific industry. To chair manufacture the name of Heywood bears this relation.

THE RISE AND GROWTH OF THE HEYWOOD-WAKEFIELD COMPANY

The foundation of the vast \$13,000,000 Heywood-Wakefield Company is the Gardner factory, the successor of the chair manufacturing enterprise, established there, in 1826, by Walter Heywood, brother of Levi Heywood, who, later was to achieve lasting fame, as the inventor and patentee of chair-making machinery that revolutionized production. In a little shop, adjacent to his home, located on the site of the Gardner city hall, Walter Heywood started making chairs by hand, his only machine being a foot lathe. A year or two later he removed to a larger shop, where he continued the business, with Benjamin F. and William Heywood, Moses Wood, and James W. Gates, under the name of B. F. Heywood & Co. In 1831 the water privilege and shop of Merrick Wallace were purchased, and the enterprise was carried on at the two locations for three years, when the old shop was burned and not rebuilt. The site of the present Gardner plant is on the old mill privilege location.

In 1835 Levi Heywood entered the firm, and four years later purchased the interests of the other partners. Between 1844 and 1851 others came into the firm, but, in 1861, when the factory was burned, a new partnership was formed under the name of Heywood Brothers & Co., which continued until 1897. From common wooden-seated chairs of the early days, came the flag-seated type, and, in 1833, the chair with seat of cane, followed by reed chairs and furniture, about 1876.

Among the more important inventions made by Levi Heywood were the machines for the manufacture of wooden chair seats, one for the tilting chair, and several processes for wood bending that caused Francis Thonet, of Vienna, the head of what in his era was the largest chair-manufacturing plant in the world, to exclaim on a visit to the Heywood factory: "I must tell you candidly that you have the best machinery for

bending wood that I ever saw, and I will say that I have seen and experimented a great deal in the bending of wood."

Power looms for weaving cane web for chair seats and for splicing cane were also included in Levi Heywood's inventions. To provide raw material for the rattan products, the company established an agency in Singapore, where machinery for splitting and shaving rattan, in large part designed by Mr. Heywood, was installed.

In 1870, a half interest in a chair plant, operated by W. B. Washburn, at Erving, was purchased, and operated for a time as the Washburn & Heywood Chair Company.

In 1886 the Chicago factory was erected.

By 1896 the company had three factories and warehouses in eight cities in the United States, and its annual sales were \$1,800,000.

In 1897 a consolidation was effected between Heywood Brothers & Co., and the Wakefield Rattan Company under the name of Heywood Brothers & Wakefield Company, with capital of \$6,000,000. School desks were added to the line at Gardner, and opera chairs at Chicago.

In 1902 the corporation acquired the plant of the Oregon Chair Company, of Portland, Ore., and the following year the plant of the Lloyd Manufacturing Company at Menominee, Mich., and the Lloyd patents for weaving fibre, and those covering the application of woven fibre to the frame. In 1921 a factory was established at Orillia, Canada, and three additional warehouses were established between 1889 and 1921, giving the concern eleven distributing depots.

The annual normal output today is approximately \$15,000,000 and, in addition to its domestic and Canadian sales, the concern exports to South and Central America, and the West Indies, and employs in all its factories and warehouses upwards of 5,500 men and women.

Under the able management of Hon. Levi H. Greenwood, the corporation during the past quarter of a century has made wonderful strides until today in its factories at Gardner and Wakefield, Mass., Chicago, Menominee, Mich., Portland, Ore., and Orillia, Canada, 2,518,957 square feet of floor space are occupied, while the eleven warehouses contain 1,872,530 square feet of floor space. Late in 1929, owing to illness, President Greenwood resigned that office and became chairman of the board. He was succeeded by his son, Richard N. Greenwood. Henry C. Perry is treasurer and secretary.

P. DERBY & CO., INC.

For years, travelers have noticed with interest the enormous chair which stands on the grounds of the railroad station at Gardner.

This chair not only typifies the city's leading industry, but is more especially the mark of P. Derby & Co., Inc., in whose shops it was built some twenty-five years ago.

The story of this concern runs back the greater part of a century. In 1844 Philander Derby came to Gardner from Vermont, where he had been engaged in the manufacture of chair stocks, and brought with him a quantity of specially selected lumber to use in the manufacture of chairs.

Soon Derby's "Boston Rockers" and stenciled chairs brought him a very satisfactory business and no little personal fame. When he outgrew the status of an independent craftsman a partnership known as

Derby, Knowlton & Co., was formed, which, in 1863, bought a factory that stood on the site of the present plant. To this building he made extensive additions, and entered into the manufacture of chairs on a considerable scale.

Five years later Mr. Derby bought the interests of his associates and conducted the business under the name of P. Derby & Co. That the product of the concern was in keeping with the tradition of fine chair making which eventually raised Gardner to the position of the world's leading chair town is evidenced by the fact that at the time of the Centennial Exposition, in 1876, the Derby Company received the first award for chairs.

In 1885 another partnership was established consisting of Messrs. P. Derby, Arthur P. Derby, George Hodgman and George W. Cann. In 1907 the concern was incorporated under the laws of Maine, and four years later was reincorporated under Massachusetts laws, as P. Derby & Co., Inc. In 1912 the company acquired, through merger, the property of P. Derby & Co., a New York corporation, the entire stock of this latter concern having been owned by it.

On the death of Arthur P. Derby, in 1910, his son, Ashton P. Derby, became president of the company and has continued in that office to the present:

Throughout its entire history, the chief product of the company has been chairs, but from time to time subsidiary lines such as reed furniture, desks, tables and phonograph cases have been produced.

At the present time office and Windsor chairs and school seats and desks are produced. The office chair end of the business becomes constantly of more importance. In 1925 a new type of chair, the seat and back of which are scientifically designed to follow the natural contours of the body, giving support where it is needed most, and tremendously increasing seated comfort, was introduced by the concern. These correct posture features are fully protected under the Earl Thompson correct seating patents. The growing interest of business men in seating equipment which tends to make workers more efficient provides an expanding market for correct posture furniture, and indicates the lines along which the future development of the company will probably take place.

The corporation has capital of \$270,300, and employs 200 operatives. Ashton P. Derby is president and treasurer, and C. L. Crabtree, clerk, and the company has its Boston office, at 199 Friend Street.

THE CONANT BALL COMPANY

In 1852, Aaron B. Jackson and Aaron L. Greenwood, under the firm name of Jackson & Greenwood, built a chair shop on West Broadway, in South Gardner, and were succeeded, in 1857 or 1858, by Abner and Leander White, who carried on business as A. White & Co.

In 1862, John H. Conant entered the firm, and in January, 1864, Leander White withdrew from the enterprise, and Charles W. Conant, a brother of John H., became a partner. Two years later, Abner White retired, and the business was continued as Conant Brothers & Co. In 1868, Carlos E. Ball was admitted to the firm, and assumed charge of the Boston branch of the business, which was then located at 36 Richmond Street. In 1875, Charles W. Conant retired from the concern although he retained

an interest in it until 1884, and the firm name was changed to Conant, Ball & Co. On December 14, 1891, John R. Conant died, and Carlos E. Ball continued the business alone until April 20, 1896, when Edward Clinton Ball was admitted to partnership.

Charles C. Brooks became a member of the firm on August 1, 1905. Charles E. Ball died on January 10, 1909, and in May of that year a Massachusetts corporation was formed, under the name of the Conant Ball Company, which concern has since continued the business.

In 1898, the factory was removed to its present location, on Lynde Street, West Gardner, at the time the concern purchased the chair plant of L. H. Sawin & Co. Many large additions have been made to the original buildings, the important extensions having been completed in 1906, 1907, and 1912. All are equipped with every modern improvement.

For almost forty-three years the Boston headquarters were maintained on Richmond Street, but in 1921, they were removed to larger and more modern quarters, at 78 Sudbury Street, equipped with freight elevators, sprinkler systems, and lighting and display fixtures. The buildings include five large floors and basement, with additional floor area in an adjoining structure.

The Sawin factory when erected occupied the site of the first water privilege that was created on the stream which had its source in Crystal Lake, and was originally used by Deacon Noah Fairbanks, who built a dam and grist mill on the site early in the last century. About thirty years after he erected his mill he sold the property to Ezra Baker, who for a number of years was engaged in preparing chair stock. He subsequently sold the business, but not the realty, to Elijah Putnam, who began the manufacture of chairs there. About 1840 the shop was destroyed by fire, but was rebuilt by Mr. Baker, who leased it for a time to the Messrs. Heywood, who utilized the facilities for the purpose of preparing chair stock. In March, 1881, L. H. Sawin purchased the buildings and immediately began the manufacture of chairs, and four years later the old shop was removed and a portion of the present factory was built, to which an addition was made in 1865.

In 1861, M. T. Osgood associated himself with Mr. Sawin, and a partnership under the firm name of Sawin & Osgood, continued until 1869, when Mr. Osgood withdrew, and Mr. Sawin carried on the business with his sons, under the firm name of L. H. Sawin & Co. At that period the main factory building was 120 by 40, in dimensions, and employment was given to from thirty to forty men.

The first products of the founders of the Conant Ball Company were cane seat chairs. Later, mahogany, cherry and walnut chairs were manufactured, but today the concern is famous in the furniture world for its colonial line of beds, dressers, chairs, and tables.

In September, 1929, another forward step was taken by the corporation, when it purchased the plant owned by the Bourn, Hadley Company in Templeton, the transfer including not only the factory buildings and land, but the stock, machinery and bills receivable.

The Conant, Ball Company took possession at once and now operates the plant as a branch of its Gardner factory. The same line of Colonial furniture manufactured at Gardner is being produced at Templeton, and the post office furniture made by the Bourn, Hadley Company was discon-

tinued.⁷ Charles F. Hartwell, of Gardner, is superintendent of the Templeton plant.

The Bourn, Hadley Company was one of the oldest enterprises in Templeton, and George W. Bourn, its treasurer for twenty years, retired after having completed fifty years of service with the company. The present plant, which is modern in every detail, was built about fifteen years ago, to replace old buildings which were burned, and about thirty men were employed up to the time of the disposal of the assets to the Gardner corporation.

The Conant Ball Company has capital of \$270,000, and employs upwards of 250 employees. Charles C. Brooks is president, Edward Clinton Ball, treasurer, and Theodore Eaton, secretary, these three constituting the board of directors. Mr. Ball is in charge of the Boston warehouse and office.

THE MAHONEY CHAIR COMPANY DATES BACK TO 1855

What has long been known as the Mahoney Chair Company was founded in 1855, for the manufacture of "old Grecian rockers," the parts being shaped by hand, as motor driven shapers, and other chair-making machinery did not exist at that period. The plant was built and owned by C. S. Greenwood, and contained about 6,000 square feet of space, the concern employing about a dozen men. When woodworking machinery was developed, the line was extended to dining-room chairs, and E. H. Mahoney became interested in its management, but later sold to Charles H. and Frederick M. Greenwood, who operated the concern until their deaths, and who changed the type of products to single folding chairs and portable assembly chairs, for auditoriums, churches, lodges, and halls. The industry has had a steady growth and now utilizes more than 60,000 square feet of manufacturing space, employing about seventy-five operatives. It is owned by the three sons of the late Frederick M. Greenwood.

C. S. Greenwood is president, treasurer and secretary, and W. N. Greenwood is vice president, they, with A. R. Greenwood, Mrs. G. L. Carlton and Mrs. E. W. Derby constituting the board of directors.

The corporation has capital of \$60,000 and has offices in Boston and New York City.

SOME OF THE OLDER INDUSTRIES OF GARDNER

For more than sixty years, John A. Dunn was engaged in chair manufacturing, in Gardner, purchasing in 1864, with Nathaniel Holmes, the interests of Thorley Colleston, in the chair-producing firm of James M. Comee, who was the pioneer Gardner manufacturer of chairs.

In 1875, A. J. Dunn entered the firm, and for eleven years thereafter it was known as J. A. & A. J. Dunn. In 1902, the John A. Dunn Company was incorporated and, following a disastrous fire that year, which wiped out the original factory, a new brick building was erected, and water-power was supplanted by steam and electricity. Mr. Dunn saw the business grow from sales of \$2,000 monthly, in 1864, to over a million dollars a year.

Today, the concern is capitalized for \$1,750,000 and employs 700 operatives. George A. Dunn is president and Frank C. Dunn, treasurer and secretary. The corporation has its Boston office at 27 Haymarket Square.

In 1867, Samuel Bent purchased a small shop, owned by his brother,

and formed a partnership with his youngest brother, Roderic L., under the firm name of S. & R. L. Bent, into which Charles O. Bent, a third brother, entered the following year, creating the present-day firm of S. Bent & Brothers. They manufacture children's and dining chairs, and baby-jumpers, and, in 1910, the business was incorporated as S. Bent & Brothers, Inc. The concern has capital of \$75,000 and employs 125 operatives. C. Leslie Bent is president, and A. E. Priest, secretary and treasurer.

For seventy years the firm now known as the Nichols & Stone Company has held a significant position in the history of the chair-making industry, of Gardner, starting as Stone & Wyman and assuming its present name in 1893, when Charles Nichols and Reuben S. Stone formed a partnership, under the present name. In 1857, Fred and Francis Nichols, brothers of Charles Nichols, established a small factory in Westminster, which was later bought by the latter and another brother, Marcus. In the early nineties, the business was removed to Gardner on the completion of a modern brick plant, to which many additions have since been made. In 1907, the company was incorporated. It has long specialized in the production of Windsor chairs and has gained an enviable reputation in the industry. The corporation has capital of \$500,000 and employs upwards of 150 operatives in its modern and splendidly appointed plant.

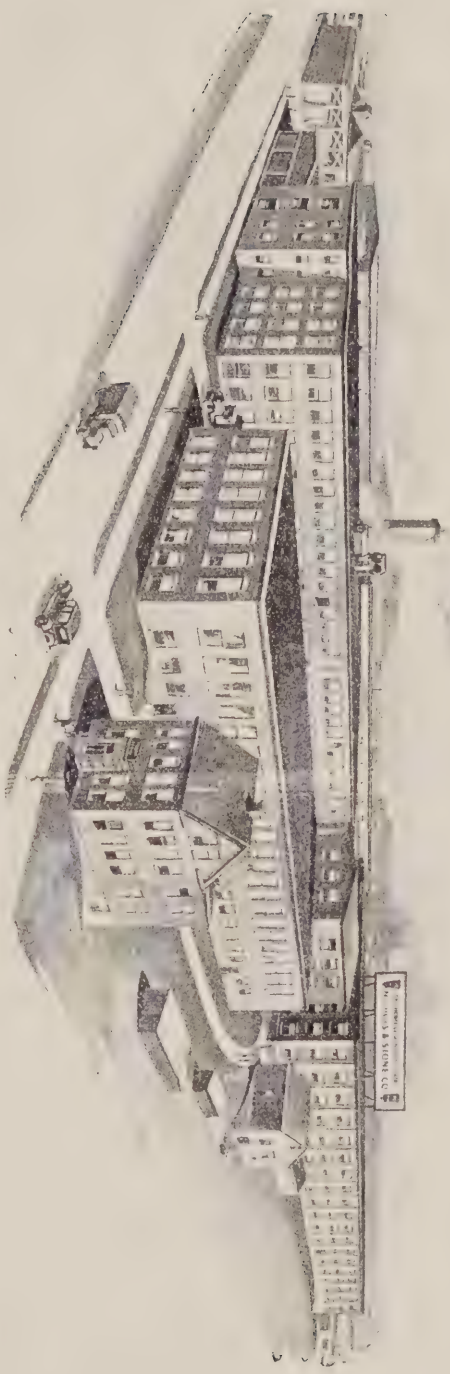
Hon. Albert H. Stone, the present mayor of Gardner, is president, and Edmund L. Nichols, treasurer, of the concern, they, with Reuben S. Stone, Carl A. Raymond and Frank W. Fenno constituting the board of directors.

THE GENESIS OF THE FLORENCE STOVE COMPANY

In 1884, the late Hon. William H. Wilder, A. M. Greenwood and Calvin H. Hill began the manufacture of oil stoves in a small way, the inventive genius of Mr. Wilder proving invaluable to the original concern. From 1884 to 1899 there was not a single year that at least one patent on these commodities was not granted to him, and before his death, in 1913, he had been the recipient of upwards of fifty patents, many of them basic, on oil stoves and ranges. As his original partners were active in the chair business, the oil stove development was left to Mr. Wilder's care, and he was a prominent factor in effecting a consolidation of thirteen plants, in 1890, under the corporate name of the Central Oil-Gas Stove Company. Factories were operated in Massachusetts, Connecticut, and Michigan, with warehouses in Boston, New York, and Chicago. In 1895, the business became financially involved, with indebtedness amounting to \$250,000, but Mr. Wilder personally assumed all the obligations, although neither legally nor morally obliged so to do, and before his death the entire amount was paid, or abundantly secured. The following year he organized the business in Gardner, and, in 1897, placed on the market the famed blue-flame oil stove, manufactured under his patents, and built up a business which restored his fortunes.

In 1903, the purchase of the assets of the Florence Sewing Machine Company at Northampton, was effected, that concern being then engaged in the manufacture of oil stoves and wooden display cabinets. It was merged with the Central Oil-Gas Stove Company, of Gardner, which, later became the Florence Stove Company and ultimately the second largest

NICHOLS & STONE COMPANY, GARDNER



industry in that city, employing 600 hands in the manufacture of stoves and ranges.

The corporation has capital of \$1,000,000 preferred stock, and 30,000 shares of no par common stock.

Harry D. Carter is president and treasurer, Fred E. White and Harry H. Morse, vice presidents, and John H. Foster, assistant treasurer and secretary.

LOCAL CONCERNS ESTABLISHED IN THE NINETIES

In the early nineties, Charles H. Hartshorn began furniture manufacturing on a small scale, and adding reed baby carriages to the line, soon built up a business which demanded the erection of a four-story building, in 1907, to which extensive additions were made in 1914, 1916, and 1920, until, today, over 50,000 square feet of manufacturing space are utilized by C. H. Hartshorn, Inc., the corporation coming into being in 1923. Seventy-five employees are carried on the payroll, and the corporation has authorized capital of \$250,000. Hon. Charles H. Hartshorn is president, Stanley H. Hartshorn, treasurer, and C. H. Hartshorn, Jr., clerk.

In 1894, William H. and Edgar N. Hobby formed the Gardner Machine Works, the senior member of the firm having solved many problems of the chair industry by designing and building machines which have revolutionized the industry, by tripling and quadrupling the output in plants where they have been installed. The concern employs twenty hands.

In 1898, Ellsworth F., Charles F., and Benjamin J. Brown founded the Brown Brothers Company which continued as a partnership until 1902 when it was incorporated. An annual business of \$500,000 has been built up in the manufacture of chairs, and tea and breakfast room furniture, upwards of 150 hands being employed. The corporation has capital of \$400,000. Benjamin J. Brown is president and treasurer, and M. A. Bodett is secretary.

The reader must not gain the impression that Gardner has not been alive to its industrial opportunities in the twentieth century. While many enterprises were established there in the last hundred years, the record of new concerns, established during the first quarter of the present century, is remarkable.

SOME TWENTIETH CENTURY ENTERPRISES

In 1904, the business founded early in the seventies by Levi Warren was reorganized and incorporated as the L. B. Ramsdell Company. The concern were pioneers in the use of fibre in the production of baby carriages and chairs, having used it as a raw material many years before it was adopted by practically all of their competitors. When Thomas E. Cody, who was identified with the company and its predecessors for more than fifty years, entered its employ, less than a dozen names were carried on the payroll, while today upwards of 250 hands are employed, and the manufacturing space utilized is more than ten times that of fifty odd years ago.

The corporation has capital of \$90,000 and Levi E. Smith is secretary, and Paul L. Cody, is treasurer, the latter having succeeded to that office upon the death of his father, Thomas S. Cody, in 1929.

In 1906, David R. Collier and George A. Keyworth, formed the Collier-Keyworth Company and engaged in the manufacture of children's carriages, go-carts, carriage gears and office-chair irons, and six years later erected the present factory, containing 80,000 square feet of manufacturing space. The concern now employs 150 hands and ships its products to all parts of the world.

The corporation has capital of \$80,000. David R. Collier is president, George A. Keyworth, treasurer and H. F. Howe, secretary, of the corporation.



COLLIER-KEYWORD COMPANY, GARDNER

In 1910, Edward W. Pierce bought the Lovell Machine Works and, with William Chesworth, incorporated the concern as Pierce & Chesworth, Inc. It owns some valuable patents on wood-working machinery, which constitutes its product.

Fred T. Coffin began the manufacture of chairs, in Hubbardston, in 1910, and two years later removed to Gardner where he organized and incorporated the Gardner Chair Company which, in 1917, he sold to Joseph P. Carney, and established the Coffin Chair Company which specializes in dining and chamber chairs, and employs fifty hands.

CONCERNS THAT ADD TO THE HAPPINESS OF CHILDREN

Next to the chair industry, probably the most potential in Gardner is the kindred line—the manufacture of childrer's vehicles. The rapid development of this industry, the advancement in processes during the past decade, and the great expansion in production constitute no inconsiderable part of Gardner's present-day industrial program.

In 1912, Carl J. Hedstrom, Fred Richardson, Wilford J. Shuttleton and Frank M. Favor organized the Gem Crib & Cradle Company as a partnership and in less than a score of years the concern has added to its plant until today it has 75,000 square feet of manufacturing space, and employs 200 hands in the manufacture of children's furniture. The corporation has capital of \$150,000, and Walter L. Beaman is president and secretary, and Wilford P. Shuttleton, vice president and treasurer.

The Hedstrom-Union Company capitalized for \$200,000, of which Carl H. Hedstrom is president, employs 250 hands in the manufacture of baby-carriage hardware, this concern being a merger of the old Hedstrom Company and the Union Manufacturing Company, both of which were engaged in the same line of production.

Plants are operated in Gardner and East Templeton. C. H. Hedstrom is president, Gustaf Hedstrom, treasurer, and Oscar Fowelin, secretary.

In 1917, the Frank W. Smith Company was reorganized and incorporated with capital of \$150,000, and its production of sterling silver, hollow and flat ware, is carried on in a modern factory, with fifty employees.

Henry E. Heywood is president, and W. W. Allen, treasurer, of the corporation.

In 1919, Thomas F. Denney, James H. Noonan and William A. Earle organized the Gardner Upholstered Furniture Company, Inc., and two years later the Hubbardston Chair Company for the manufacture of wood-seat chairs and specialties. The two concerns employ seventy-five hands. The Gardner Upholstered Furniture Company has capital of \$100,000, and Mr. Denney is president, Mr. Earle, vice president, and Mr. Noonan, treasurer and clerk.

In 1919, the Kuniholm Manufacturing Company was founded by W. Gardner, Eric and C. Harry Kuniholm, with capital of \$50,000, for the manufacture of wire wheels and baby carriage hardware. W. Gardner Kuniholm is president, Eric Kuniholm, vice president, and C. Harry Kuniholm, treasurer, of the corporation.

GARDNER'S ENTERPRISING MANUFACTURERS ENTER A NEW FIELD

There are those who assert that Massachusetts has not developed a new idea or commodity in a generation, but authorities who are conversant with the facts know that such a statement is as erroneous as many others applying to the industrial position of this Commonwealth.

Within the past decade there has come into American manufacture a twisted cord, made of Kraft paper, which has largely supplanted reed and willow, because of its more artistic appearance, and its lower cost, with the result that practically all of the baby carriages and approximately seventy per cent of all the furniture made in the United States employ this new material, and it is interesting to note that three of the four concerns weaving this commodity are located in Massachusetts — the American Fibre Corporation, and the Heywood-Wakefield Company, both of Gardner, and the F. A. Whitney Carriage Company, of Leominster, and together they produce approximately 75% of all the loom woven fibre made in the United States.

One of the largest single units, the American Fibre Corporation, of Gardner, was not incorporated until June 7, 1920, and therefore is less than ten years old. This concern is producing a million dollars worth of fibre cord each year, which is woven into web of various widths from two to ten feet, not only in plain but Jacquard design.

The American Fibre Corporation, of Gardner, is capitalized for \$200,000 and employs 200 hands.

O. W. Siebert is president, J. F. Vogel, vice president, and George A. Keyworth, treasurer, of the concern.

THE O. W. SIEBERT COMPANY

On January 1, 1922, the O. W. Siebert Company began operations as a partnership, being incorporated a year later. For eighteen months business was carried on in premises leased from P. Derby & Co., Inc., and the Nichols & Stone Company, but in September, 1923, the concern moved to its modern factory, four stories high, 232 by 80 feet, plus boiler rooms and storehouses, covering an area of 40,000 square feet.

In less than eight years the concern has become the third largest manufacturer of baby carriages in the United States, and the largest producer of doll carriages in the country, the 1927 business exceeding \$1,000,000. Kiddie cars and baby walkers are also included in the products.

Oscar W. Siebert, president of the concern, had served as treasurer of the Bay State Metal Wheel Company, and the Children's Vehicle Corporation, both of East Templeton, for twenty-three years, previous to organizing the company which now bears his name. He has been president of the American Fibre Corporation since its formation, in 1920. Capitalized for \$750,000, the Siebert concern now employs 200 operatives. F. E. Depinet is treasurer of the corporation.

SOME OTHER GARDNER INDUSTRIES

In 1923, George E. O'Hearn formed the O'Hearn Manufacturing Company with \$200,000 capital, and began the manufacture of fibre web living room suites, upwards of fifty hands being employed. George E. O'Hearn, Jr., is president and secretary and George E. O'Hearn, is treasurer.

The Simplex Time Recorder Company, a pioneer in the manufacture of devices for the recording of employees' time by use of a machine, whose products are exclusively used by the United States Post Office Department, and whose reputation is of the highest among American makers of time-recording devices, and watchmen's clocks, is capitalized for \$160,000 and employs seventy-five operatives. E. G. Watkins is president, F. S. Whittemore, secretary, and C. J. Underwood, treasurer.

In 1928, James G. Fuller purchased the interests of Carl H. Hedstrom and Maj. Walter L. Beaman, in the Berg Manufacturing Company, manufacturers of the Ice-Berg electric refrigerator, and water coolers, a concern that began business less than five years ago. J. H. Drury is president, Emil G. Berg, vice president, Carl H. Hedstrom, clerk, and Walter L. Beaman, treasurer.

The same year, the Eastern Wood Product Company began the local production of wooden wardrobes and nursery chairs, while the Freezel Corporation, commenced the manufacture of a new electrical household refrigerating plant, in the Motor Mart Building. This concern has capital of \$50,000. M. D. Pendergast is president, M. H. Pendergast, secretary, and Harvey N. Brooks, treasurer.

In 1928, the Victor Furniture Manufacturing Company, capitalized at \$50,000 erected a two-story addition to its plant, 48 by 88 feet, which gave it 500 more square feet of manufacturing space, a model office suite, and a new boiler room.

The corporation has capital of \$50,000.

Alectance Robichaud is president, George Le Blanc, secretary, and Prime Robichaud, treasurer.

The Atlantic Chair Company, Inc., engaged in the production of children's chairs, is capitalized for \$80,000, and employs twenty-five hands, Jerry E. Connell being president, F. A. Rothlis, secretary, and L. N. Ellis, treasurer; the Chairtown Manufacturing Company has capital of \$50,000, and employs twenty-five operatives in the manufacture of wood novelties, W. P. Shuttleton being president, Walter L. Beaman, secretary, and Ernest Bolster, treasurer; the Commonwealth Manufacturing Company, of which George A. Dunn is president, and Frank C. Dunn, secretary and treasurer, has capital of \$150,000, and employs thirty-five hands in the production of reed and rattan products; the J. A. Dickerman Company employs fifty operatives in the production of reed furniture and baby carriages, has capital of \$150,000, and is managed by D. K. Dickerman, president, D. B. Woodgate, secretary, M. J. Daly, treasurer, and W. H. Carroll, general manager; the Gardner Doll Carriage Company employs fifty hands in the manufacture of toy reed products, has capital of \$50,000 and is officered by John E. Carlson, president, and A. W. Carlson, secretary and treasurer; the Gardner Fibre Company of which Joseph P. Carney is president, and Philip H. Loughlin, is treasurer, has capital of \$100,000, and employs thirty-five hands, in the production of woven fibre; the Gardner General Foundry, Inc., has capital of \$90,000, and employs fifty hands in the manufacture of grey iron castings, Martin E. S. Anderholen being president, Gottfried E. Lund, treasurer, and Herbert W. Blake, secretary; the Gardner Screw Corporation employs thirty-five hands, and has capital of \$50,000, being engaged in the production of screw and screw machine products, E. J. McKnight being president, Bernard L. Cohen, secretary, and Theodore J. Hoglund, treasurer; the Gardner Yarn Company, owned by A. E. Robinson and M. Thorp, is engaged in the manufacture of weaving and knitting yarns, and employs thirty hands; the G. R. Godfrey Company with capital of \$50,000, employs forty, in the manufacture of harness and leather strapping and maintains a Boston office at 27 Haymarket Square, E. L. Godfrey being president, A. R. Godfrey, secretary and H. R. Godfrey, treasurer; the Greenwood Associates, capitalized at \$100,000, employ upwards of 150 operatives, located in one of the most up-to-date chair factories in the city, and operate a branch at 138 Richmond Street, Boston, the corporation being managed by Marcus J. Greenwood, president, R. M. Greenwood, vice president, G. T. Greenwood, treasurer, and H. E. Greenwood, secretary; the G. E. Hoglund Foundry Company specializes in grey iron, brass and aluminum castings, is capitalized at \$25,000 and employs forty men; the Howe, Spaulding Company, Inc., with capital of \$150,000, employs fifty in the manufacture of chairs, George M. Howe, being president, and treasurer, and George W. Spaulding, vice president; Kelley Brothers, Inc., capitalized for \$100,000, employs seventy-five hands in the manufacture of children's carriages and reed furniture, John B. Kelley being president and treasurer, and Francis M. Kelley, secretary of the corporation; the L. G. McKnight & Son Company is one of the old established manufacturing units of the city, being capitalized at \$125,00, employing fifty operatives in wood-working and chair-bending machinery manufacture, Elliott J. McKnight, son of the founder, being president, secretary, and treasurer, and Joseph N. Baker, vice president; the Nichols Rattan Products Company with capital

of \$100,000, employs fifty hands in the manufacture of cane webbing and rattan products, Frank A. Nichols being the president, Joseph N. Baker, vice president, and Elliott J. McKnight, secretary and treasurer of the corporation; the Peterboro Manufacturing Company employs fifty operatives in the manufacture of women's and children's underwear and has capital of \$25,000, Wm. G. Nunn being president and treasurer; S. K. Pierce & Son Company capitalized for \$200,000, employs upwards of 125 operatives in the manufacture of chairs, maintains a Boston office at 96 Cross Street, and is managed by F. J. Pierce, as president and treasurer, and E. F. Brainard, as general manager; the Royal Steam Heater Company of which Harold E. Drake is president and treasurer, M. D. Drake, vice president and Alvin Matthews, secretary, manufactures and installs heating, ventilating and sprinkler systems, has capital of \$35,000, and operates a branch plant in Worcester; Shaughnessy, Inc., with W. L. Shaughnessy, as president and treasurer, James F. Shaughnessy, as vice president, and H. J. McCormick, as secretary, employs sixty operatives, in manufacturing casket hardware; the American Chair Company employs twenty hands in the manufacture of juvenile furniture, Harry Morin, being president and M. O. Morin, treasurer and secretary; the Charles A. Barnard Machine Company owned by Charles A. Barnard, manufactures wood-working machinery; the Children's Furniture Corporation has capital of \$50,000, and produces juvenile furniture, John Wickman being president and treasurer and Paul Wickman, clerk; the Donlan Foundry Company, Inc., employs thirty operatives in producing grey iron, bronze and aluminum castings, has capital of \$25,000, and is managed by W. Leo Donlan, president, Frank M. Favor, secretary, and James J. Donlan, treasurer; the Gardner Bassinet Corporation has capital of \$50,000, and produces children's furniture, Wilhelm Waxlax being president, Einar Nelson, secretary and Gustaf E. Sand, treasurer; the Gardner Muslin Underwear Company employs fifty hands in the manufacture of women's and children's silk, muslin and rayon underwear, Nathan Gewandter being the proprietor of the concern; the Gardner Reed & Rattan Company, of which Edwin E. Nelson is president, secretary and treasurer, employs seventy-five operatives in the manufacture of reed commodities; the Gardner Table Manufacturing Company has capital of \$50,000 and manufactures wooden tables and novelties at its local and West Brookfield plants, P. A. Cushing being president and L. E. Cushing, treasurer; and the S. & E. Manufacturing Company with capital of \$30,000, employs twenty-five in the manufacture of wheel toys, J. S. Swanson being president, C. H. Hedstrom, secretary and Gunnar Ericson, treasurer; Gardner has some smaller manufacturing units engaged in various lines of production, but the manufacture of chairs and furniture still dominates, twenty-nine of the seventy-eight industrial concerns in the city being engaged in that line, while the value of their products in 1927 accounted for \$12,040,289 of the total of \$17,885,307.

GARDNER'S INDUSTRIAL GROWTH

In the seven year period from 1921 to 1927 the industries of Gardner increased the number of wage earners from 3,749 to 4,353, and the number of concerns from sixty-five to seventy-eight. The cost of stock and materials used rose from \$6,011,206, in 1921 to \$7,428,551 in 1927; the

wages increased in the same seven year period from \$3,680,512 to \$5,082,800, and the value of products from \$12,838,569 to \$17,885,307.

In the furniture production field the increase in value in this seven year period was from \$7,164,338 to \$8,628,599, and that in children's carriages and sleds from \$1,580,793 to \$3,411,690, while in foundry and machine shop products the totals rose in the same period from \$389,618 to \$635,535. In its principal industry in 1927—the manufacture of furniture—the product value (\$8,628,599) represented 48.2 per cent of the total value of all manufactures in the city, that year.

CHAPTER LVI

THE IMPRESSIVE LIST OF MANUFACTURING ENTERPRISES LOCATED IN THE TOWNS OF WORCESTER COUNTY

THE MANUFACTURES OF ASHBURNHAM

At a meeting of the proprietors of the town of Ashburnham on November 10, 1736, a committee of three was appointed to enter into a contract with suitable person or persons to build a sawmill, and the following spring negotiations were made with Hezekiel Gates, of Lancaster, to erect such a plant. He was granted ninety acres of land on the stream between the upper and lower Naukeag Lakes, and the town received from him a bond of \$500 obliging him to build and conduct the mill. In 1752, a second mill was erected, near the site of the first, and a third was established near the outlet of Watalie Pond, in 1758, which was owned by Moses Foster, Jr., and Zimri Heywood.

In 1772 the town sold land for a mill site to Ebenezer Conant, Jr., and after his death the property was owned by Jonas Randall, Jonathan Brooks, and others. About 1817 this mill was transferred to Water Street.

Previous to the revolution a saw and grist mill was built at the outlet of Rice's Pond.

From 1805, when John Eaton removed to Ashburnham from Ashby, and began the manufacture of chairs, the industry has continued until today as the leading product of the town. He was followed by Charles and John C. Davis, Charles Munroe, Joshua Burgess, John C. Glazier, Alvin Ward, John Conn, Harvey M. Bancroft, Lyman Conant, Thomas E. Glazier, Moses Ross, James Blodget, Joseph Rice, Josiah Eaton, Jesse Ellis, Charles S. and Sumner Ray, Hezekiah Matthews, Samuel S. Stevens, Philip R. Merriam, Charles and George C. Winchester, Orange Whitney, Edward S. Flint, Jonathan H. Piper, Abner White, Benjamin E. Wetherbee, Bernard Duane, James Osgood, George S., William F. and Charles W. Burrage, J. H., and E. L. Hodge, Charles L. and George L. Beals, Jr., and others.

Between 1825 and 1830 John Whitney began the manufacture of chairs, in Westminster, and in 1865, his son, the late Wilbur F. Whitney, purchased an interest in the Glazier factory, at South Ashburnham, disposing of his share three years later and buying the Merriam and Allen plant, in the town, which he operated for fourteen years, Irving E. Platts being a partner in the business during a portion of the period. In March, 1882, the factory was burned, and purchasing a site near the South Ashburnham depot of the B. & M. R. R. Company he immediately erected a three and one-half story plant, 136 by 40 feet, and a paint shop, 100 by 30 feet, later adding another structure, 60 by 40 feet, three stories high, with basement, which, in 1886, was further enlarged by the

addition of fifty feet, giving the W. F. Whitney Company at that time 17,600 square feet of manufacturing space. At that period Mr. Whitney employed 100 hands.

Mr. Whitney remained active in the management of the concern for practically half a century.

Today the W. F. Whitney Company is capitalized for \$500,000, employs 200 hands, and is the town's largest industrial concern.

William D. Miller is president, and Col. Oliver J. Schoonmaker, treasurer.

The Alfred H. Whitney Company has capital of \$50,000, and employs fifty-five operatives at its South Ashburnham plant, in the production of chairs. Alfred H. Whitney is president, and Marcus M. Whitney is treasurer of the corporation.

The Curtis Chair Company manufactures chairs at its Ashburnham Center plant.

The White Manufacturing Company with capital of \$99,000, employs 100 operatives in the manufacture of children's furniture and bassinets, at its South Ashburnham plant. Richard C. Whitney is president, Col. Oliver J. Schoonmaker, vice president, and M. D. Whitestone, treasurer.

In 1919 George H. and Herbert B. Hadley purchased the F. W. Lombard Company, then engaged in the manufacture of chairs, and operates the concern under its former corporate name, employing thirty hands in the plant, at South Ashburnham. W. N. Hadley is president, H. B. Hadley, vice president; F. C. Valiton, secretary, and George H. Hadley, treasurer. The Lombard Company is associated with the Athol Table Company.

The T. R. Almond Manufacturing Company produces machine tool accessories, at its plant in Ashburnham Center. C. A. Hubbell is president and treasurer, and H. S. Hubbell, secretary. The corporation has capital of \$315,000 and employs 150 operatives.

Tubs and pails, thread spools and matches and baskets have been manufactured in Ashburnham, at various times, while wool carding, cloth dressing, the tanning of leather and morocco production were some of the other local industrial activities of former years.

THE INDUSTRIAL GROWTH OF ATHOL

One of the first acts of the proprietors of Athol, following the original settlement of the town, in 1735, was to grant extensive concessions of land to Samuel Kendall, of Woburn, on condition that he would maintain and operate saw and grist mills for ten years—the two “mill-lots” so granted being located in that part of the town which today contains the highest-priced land.

During the revolution the citizens induced a clothier to locate in the town, and tradition is to the effect that when he arrived in the rebellious Colonies a short time before his advent into Athol, he was rolled ashore in a hogshead in order to escape the embargo on artisans emigrating from the mother country.

By 1793 Athol had four grist mills, six sawmills, a fulling mill, and a trip hammer, but during the first seventy-five years of its history little or no attempt was made to export locally-produced commodities beyond its borders.

Samuel Kendall was the first to develop the town's potential water resources. By means of a low dam on Millers River, at the head of the "Island," he diverted the stream into the "South branch," where he built another dam which guided the waters into a canal he created southwesterly to the low lands adjoining Mill Brook, and where he constructed a higher dam which impounded a large flow of water known for generations as Lord's Pond. Selling or leasing water privileges to various primitive industries, many small plants came into being and around Kendall's lower dam a number of thriving concerns were clustered.

In 1799 Perley Sibley, of Sutton, bought the local trip hammer, owned by David Lilley, and operated it until about 1815, when he began the manufacture of scythes, an industry that continued for fifty years thereafter.

Early in 1810 Caleb Leland bought one of the Kendall water privileges and erected a paper mill on Freedom Street, which really marked the beginning of Athol as an industrial center, and which was operated for fifty years thereafter.

Four years later Capt. Adin Holbrook, of Keene, N. H., organized the Athol Manufacturing Company, which developed the water power that now serves the L. S. Starrett Company, and began the manufacture of cotton cloth. For ninety years thereafter, through many vicissitudes, this industry was continued, and for at least a third of that period it was the outstanding manufacture of the town.

Long before the middle of the last century, Timothy Hoar developed the Lake Ellis water-power, and began the manufacture of sash and blinds.

About 1835 Prescott Jones built a boot factory, at the corner of Main and Chestnut streets, where he had formerly conducted a tannery and under his ownership, that of his son, Frederick, of Stillman Simonds, and of Milton Baker, this industry flourished for forty years. Other boot and shoe factories sprang up until by the middle of the last century Athol was one of the leading footwear manufacturing towns of the state. Charles M., Merritt L., Solon W., and J. Howard Lee, Andrew Atwood, Ozi and Ira Y. Kendall, and Franklin G., and Charles L. Lord, were among those prominent in the industry a half century or more ago.

The C. M. Lee unit survived longest, and today four shoe factories are operating in the "Lee Shops," now owned by the citizens of Athol.

In 1837, while the town possessed a cotton factory, employing fifty-five hands, and several shoe concerns, in which 116 workers were engaged, the value of its total industrial production that year aggregated but \$58,417, a figure which scarcely represents the value of a day's work in its present-day plants.

When Timothy Hoar's Lake Ellis dam gave way on December 18, 1845, not only his own plant, but many others lower down on the stream were wiped out.

Edwin Ellis rebuilt the Hoar factory, and although the concern was later harassed by fire and financial reverses, the business has survived and today is owned and operated by A. J. Raymond, who employs seventy-five operatives in the manufacture of window frames, doors and blinds. The Raymond Sash & Door Company, of which A. J. Raymond is president, and L. J. Raymond is treasurer, a subsidiary unit, operates a plant, in Cambridge.

Laban Morse was operating a factory in an old tannery plant, on Pleasant Street, near Main, at the time of the 1845 flood, and while he never rebuilt there he purchased the land on which the L. Morse & Sons shop is now located, and re-established his furniture manufacturing business there. Today the concern is owned by Sumner L. Morse, who serves as its president, and Frank F. Morse, who is vice president and treasurer, and employs seventy-five operatives. It ranks as the oldest local industry remaining in the family of the founder.

As an aftermath of the 1845 flood, Lyman Hapgood removed to Athol from Barre, and bought of Dr. George Hoyt a wrecked shoe-peg factory, where he began the manufacture of matches, and under his own name, and those of Hapgood & Smith, Edson Fitch, and the Diamond Match Company, this type of production continued until 1925, when the latter concern removed its machinery to a plant in Biddeford, Maine.

In 1847 Washington H. Amsden began the production of sash and blinds in the village of Kennebunk, operations being continued there until 1893.

John C. Hill and a group of associates established a foundry and machine tool plant, on South Street, in 1847, and this pioneer concern became the predecessor of the Athol Machine Company, which operates the unit today. It was here that Leander S. Starrett, of Newburyport, who became Athol's most prominent industrialist in later years, sought and obtained employment in 1868, in which year the Athol Machine Company was incorporated by him with capital of \$25,000 to manufacture his patented devices, chief among which at that time was the American meat-chopper.

Two years before Mr. Starrett came to Athol, he had patented the first shoe hook ever produced in America, which, with slight modification, is now universally used on shoes, and for many years the invention was used by the Foster Kid Glove Company of New York, to which concern Mr. Starrett sold the patent. Today, the Athol Machine & Foundry Company has capital of \$500,000, and employs 150 operatives in the manufacture of grinders, vises and iron and semi-steel castings. W. G. Nims is president, F. A. Ball, vice president, and A. H. Starrett, secretary and treasurer.

During the Civil War period, satinnet and shoddy plants sprung up in various parts of the town. The Millers River Manufacturing Company established itself at the Cass factory site on Canal Street and later moved to the location now occupied by the Athol Manufacturing Company. W. H. Kauffman, located first on the old paper mill site and later at Fryville, in Orange; E. E. Partridge built a factory at Partridgeville, and Abijah Hill and others erected a plant at Eagleville. The Pinedale Company operated at Pinedale, in what was formerly the Wheeler pail factory. All these units are now extinct.

In 1871 the Bates Brothers came to Athol and began the manufacture of pocketbooks, on Maple Street, later removing to Hapgood Road, and from there to the present factory on Island Street, where the concern produces pocketbooks and leather novelties, and employs upwards of seventy-five operatives. The Bates Brothers Company has capital of \$75,000. J. H. Drury is president, R. L. Dexter is secretary, and J. C. Bates is treasurer.

THE ARTHUR F. TYLER COMPANY

On April 1, 1876, Arthur F. Tyler began the manufacture of window blinds, with seven employees, at the old Cheney water mill, where the plant of the Union Twist Drill Company now stands.

In 1883 he built a new factory opposite the latter location, where he utilized steam power, and 500 feet of side track, and added at that time the manufacture of sash and window frames. During recent years outside shutters have been produced in increasing quantities, and for many years the factory has annually produced 92,000 pairs of blinds, and 170,000 window frames.

In 1905 the Arthur F. Tyler Company was incorporated, with capital of \$25,000, which was increased to \$87,500 in 1922. In normal times the company employs seventy hands. It markets its products throughout New England and New York state. For more than fifty-two years the concern has been under the management of Mr. Tyler, who serves as president and treasurer of the corporation. Charles E. Worrick is secretary.

THE L. S. STARRETT COMPANY

In 1880 Leander S. Starrett founded the L. S. Starrett Company and began making squares, calipers, rules, etc., the line being gradually extended until today the concern ranks as the largest unit in the United States engaged in the manufacture of the type of small tools in which it has specialized during the last fifty years. It employs 750 workers, and ranks as the largest manufacturing concern in Northern Worcester County.

Its influence has had more to do with the growth and progress of Athol than any other concern located there.

During the first year of the existence of the company it employed ten men, and at the turn of this century it was occupying 60,000 square feet of manufacturing space. Today its modern plant contains upwards of five acres of producing area, and its line of products has been extended to include practically all types of small tools, steel taps and hack saw blades, and although the machine tool industry has been almost continuously depressed since the war, the Athol concern year after year has been able to report a tidy sum of net profits for its stock. The company has outstanding \$2,000,000 of common and \$1,350,000 of 6 per cent preferred, both \$100 par. On the common the earnings in 1927 were equal to \$26.62 a share, compared with \$30.12 a share in 1926, \$17.11 in 1925, \$12.35 in 1924 and \$25.15 in 1923. The 1927 earnings were calculated on the entire authorized amount of common \$2,000,000, although the company had in its treasury 5,149 shares of common, as well as 1,756 shares of preferred.

Starrett paid dividends of \$16 a share on the common in 1927, and in 1926, as against \$12 a share in the three preceding years.

Within recent years it has made many additions to its list of precision tools, largely in the interest of better facilities for automobile service garages and repair shops. A new V-edge protractor for more accurate checking of the perpendicular alignment of the cylinders of a motor; a new micrometer caliper for the convenience of garage men, and new gauges of various types have been evolved, including a longleaf thickness

gauge especially suited to automotive uses. A hacksaw frame for cutting Ford bands, brought out a few years ago, has proved very successful.

More than 2,500 items are included in the products of this establishment.

The company maintains a New York branch and also branches in Chicago and London, where large stocks are carried.

Frank A. Ball is president; W. G. Nims, vice president, secretary and treasurer, and A. E. Hastings, assistant treasurer.

Among the earlier shoe manufacturing concerns of Athol were Hill & Greene, who began operations in 1889 and the Athol Shoe Company, which erected in 1887, a large factory as an auxiliary plant to the Rochester and East Rochester, N. H., plants owned by F. W. Breed.

THE UNION TWIST DRILL COMPANY

In 1893 Messrs. Gay and Ward acquired an abandoned water-power, and erected a modern brick factory to which they removed a portion of the L. S. Starrett business they had purchased.

In 1905 the enterprise was incorporated as the Union Twist Drill Company, Leander S. Starrett becoming financially interested in it. He observed the company's growth until like the concern bearing his name, it came to occupy nearly five acres of floor space, and attained rank as one of the largest plants in the world devoted to the manufacture of twist drills, gear and milling machines, cutters, reamers and machine tools.

No fewer than 14,700 sizes and kinds are listed in this concern's catalog of products. It manufactures every size of drill, ranging from half a millimeter to 100 millimeters in diameter, and its customers range from the American Locomotive Works to the Waltham Watch Company. The company has conformed to the national movement for simplification of standards, reduction of 40 per cent having been made in respect to taps and about 10 per cent in the case of cutters.

Besides the big Athol plant, having a normal force of 600 employees, the concern operates branch factories at Rock Island and Quebec, P. Q., and Derby Line, Vt., employing 400 in the two establishments, and the S. W. Card Manufacturing Company at Mansfield, in this state, employing 300.

The company does a large export business in England, Switzerland and Czechoslovakia.

In 1929 the stockholders received notice of the calling of the senior stock issue for redemption at its callable price of \$110 per share. It was expected that from \$500,000 to \$750,000 par value of stock would be retired.

This action called to mind the notable progress made in 1928 in sales and earnings. From a peak of \$3,129,600, the preferred stock was reduced to less than \$1,500,000, a large portion of which cut was accomplished in 1927 and 1928. Retirement of this additional \$750,000 left outstanding less than 7,500 shares. The funded debt of \$1,098,000 was wiped out in 1926.

Operations of the machine-tool and machinery unit were maintained in 1928 at capacity with operating force considerably larger than in 1927. Although General Motors Corporation takes but a small portion of the

entire output, the automobile unit ranks as one of the company's important customers. The corporation has capital of \$4,129,600.

W. B. McSkimmon is president; Simon McKay, vice president; J. H. Horigan, secretary, and J. H. Drury, treasurer.

THE "WHITE" MILL

In 1847 coincident with the building of the Fitchburg Railroad, Nathan Bowker, of Templeton, and John C. Hill, of Athol, acquired several tracts of land on Mill Brook, below the Lord's Pond power, and built a dam across the stream, erecting on the southern half the factory, which later was occupied by the Athol Machine Company, and on the northern half they built the "White Mill" as it was known for half a century.

Bowker soon released his interest to his partner, and the latter disposed of the "White Mill" to George Farr and Joseph F. Dunbar, who, under the style of Farr & Dunbar, manufactured matches, pails and other wooden products there for ten years, until they were forced to liquidate during a general industrial depression. In the settling of the firm's affairs, the mill again passed into the hands of John C. Hill, who fathered many Athol industries in that period. Believing in the possibilities of satinet or shoddy cloth manufacture Mr. Hill and George T. Johnson organized the Millers River Manufacturing Company, which took over the "White Mill." After ten successful years this concern acquired a larger water-power of Joel Kendall and built a new mill, selling the old plant to Mr. Johnson, then president of the company, and the title remained in his name and that of his estate for a quarter of a century.

During this period several small industries occupied the plant, the last being a soapstone company, which brought its product from Tully Mountain, in Orange. In the '90s, the mill was sold to Horace Hager, who began the manufacture of paper boxes.

THE N. D. CASS COMPANY

In 1893 Nathan D. Cass, then a young man who came to Athol from Amsterdam, N. Y., where he had gained experience in the box business, found employment in the Hager factory, and three years later, in company with Mr. Gilkey, he formed a partnership and bought the Hager business. In 1903 Gilkey sold his interests to Mr. Cass, who in less than ten years after he removed to Athol became the sole owner of a prosperous paper box factory, employing twenty-five hands. He saw the possibilities of making paper and later, wooden toys, and in 1904 he added a modest line of these commodities to his output. From that day the growth of the business has been steady and rapid. The old "White Mill" was soon outgrown and has been built over and around until its identity is lost in a large area of buildings. A cabinet shop on an adjoining lot was acquired years ago and made a part of the Cass plant; encroachments have been made on the old mill pond for new buildings; and another large factory was bought for a warehouse, and another, four stories high, was erected three years ago. The N. D. Cass Company is today the largest shipper in Athol and but two industries in the town exceed it in the number of employees or in the gross value of output.

A few years ago the N. D. Cass Company of Vermont was organized at Manchester, Vt., and a modern toy factory erected there but this was

later burned and the business removed to Athol, the Vermont unit being devoted exclusively to lumbering operations.

The Cass Company has timber tracts covering about thirty square miles near Manchester, Vt., and operates a steam sawmill producing from 30,000 to 40,000 feet of lumber daily for the use of the Athol plant and large furniture concerns of Grand Rapids, Mich.

About the time the Vermont factory was built the Wilcox Comb Company of Athol became financially involved and Mr. Cass was chosen receiver by the creditors and speedily adjusted the finances of the concern, now known as the Wilcox Novelty Company, a rapidly growing business in which Mr. Cass has a considerable interest.

The Cass Dairy Company operates an extensive stock farm in Athol, handling only registered Ayrshire cattle.

The active management of all the Cass interests is cared for by William F. Cass, son of the founder, while N. D. Cass devotes much of his time in summer to travel and recreation and spends his winters at Haines City, Fla., where he has a winter home and extensive orange groves.

Two hundred and fifty hands are employed at the Cass toy plant, and the company is affiliated with the C. E. Bradley Company of Brattleboro, Vt., which manufactures tenpins and brush handles, and it controls the Gardner Screw Company of Gardner, which makes toy handcuffs that are sold by hundreds of thousands through the N. D. Cass Company.

To meet a demand for more storage capacity the Cass concern recently rented the three upper floors of the Lee shoe building.

O. J. POWERS & SONS

In 1876 Orrin J. Powers began the manufacture of straw hats in Prescott, his native town, and there and in Palmer he carried on the business until 1900 when removal to Athol seemed desirable and that year the firm of O. J. Powers & Son was established, which today employs seventy-five in producing straw hats.

The partnership is made up of O. J., E. O., and A. I. Powers.

THE WILCOX NOVELTY COMPANY

About forty years ago Joseph Wilcox, Sr., was engaged in the manufacture of combs, in Newburyport, later transferring his business to Leominster, where he added aluminum hair pins to his line of production. In 1895 he removed his business to Worcester and produced celluloid combs, but when fire destroyed his plant, in 1900, he transferred his activities to Athol where he carried on business for more than a quarter of a century, first under the name of Joseph Wilcox and, since 1920, as the Wilcox Novelty Company. The comb and hair ornament production was gradually superseded by clock and toilet set lines. The concern maintains offices in New York, Chicago, and Boston, has capital of \$50,000 and employs 150 operatives. Joseph S. Wilcox is president; M. H. Wilcox, vice president; William S. Duncan, secretary and Nathan D. Cass, treasurer.

THE ATHOL MANUFACTURING COMPANY

Another local industrial venture inaugurated by the late Leander F. Starrett is the Athol Manufacturing Company, which has capital of \$900,000, and employs 250 operatives in the manufacture of artificial leather.



PRESENT PLANT OF N. D. CASS COMPANY, ATHOL

For two years after it was incorporated, in 1915, little progress was made, and the company dates its real history from 1917.

Valuable water rights on Millers River were acquired through the purchase of an idle shoddy mill, new machinery was installed, and by the summer of 1917, the output was about 3,000 yards per day. In 1919, modern, fireproof brick buildings were erected to take care of the increased demand for the company's products, and a dye house and a unit for the nitration of cotton were erected. At that period, a large portion of the output was being sold to the automobile trade in Detroit, and the deflation of 1920 brought severe reverses to the company, but by 1923 all the lost ground had been recovered.

Up to 1922 the concern specialized on upholstery goods, but in that year, the equipment was so changed as to manufacture light-weight fabrics, such as are used in bookbindings, jewelry cases, pocketbooks, toys, fancy leather goods, suitcases, trunks, luggage, dress trimmings, card table coverings, kitchen shelving, baby carriage hooding and upholstering materials, some of the products going into the automobile industry. In less than six years time the yardage produced was stepped up to four million yards a year. Some 2,100 different shades in color effects are carried, with some eighty distinct designs. The company's product is a cotton cloth, coated with nitro cellulose solution, or pyroxylin. Pigments are mixed with the coating solution in such a way as to give the cloth a waterproof coating, which can be embossed in either leather designs or those simulating silk.

The plant has been operated on a 24-hour basis for a long time past, and the 1928 output exceeded 4,000,000 yards.

Edwin A. Clare is president and Ira B. Wheeler, treasurer and clerk.

METROPOLITAN CAMP GOODS COMPANY, INC.

The Metropolitan Camp Goods Company, Inc., is another of the L. S. Starrett enterprises and one of the more recent developments in which he was interested.

It occupies a unique field in industrial production, manufacturing pneumatic goods and camping supplies, including air inflated mattresses, cushions, canoe pads, and the basic idea of these popular specialties has now been applied to the production of a line of air mattresses with detachable covers that can be removed and cleansed readily, designed for hospital use. Sportsmen and campers are familiar with the comfort sleeping pocket, an ingenious article which combines practical and sanitary ideas, and which has proved to be one of the company's popular commodities. A raincape, a one-piece garment open at the side and sleeves for hunters, campers and golfers is another recent addition and the concern is now directing its attention to the aviation field.

For years the company has featured a line of tents made in various sizes and shapes to fit the needs of various classes of campers and designed with the regard to proper ventilation, portability and general convenience, including compactness in transit. Take-apart boats and canoes are also produced at the plant.

The company now employs twenty-five operatives at its factory, which now covers 12,000 square feet of manufacturing space. The officers are Willard H. Nims, president, Wm. S. Duncan, secretary and R. A. Whall, treasurer and manager. The latter, more popularly known as "Dick"

Whall has come to be known as an expert on camp craft and his advice is much in demand among sporting and recreation associations, while he is a prominent figure at all the sportsmen's shows.

Leander S. Starrett lived to see the five manufacturing concerns to which he gave his time without stint, grow to prominent and unique positions in the industrial life of Athol and the Commonwealth, and it is doubtful if any town of its size has possessed within the past two generations, a citizen who rendered such conspicuous service in making two blades grow where but one grew before, as did this public-spirited industrial benefactor of the municipality.

THE GEORGE H. WEBSTER SOLE COMPANY

The history of the George H. Webster Sole Company, of Athol, is the story of two Massachusetts men who possessed an idea and the courage of their conviction. The "silver spoon" success of the son-of-his father species, in which the hopeful scion, liberally endowed with good will and unlimited financial means, muddles through to success with a business, whose solid rock foundations have enabled it to withstand the battering of competition, has no part in the growth of the Athol concern.

Whatever it has achieved has been earned through the channel of hard work and intelligent management, backed by a product that shoe manufacturers recognized at the beginning as one of merit. Today, the company is the largest manufacturer of innersoles in the world.

Back in 1914 George H. Webster and Oscar L. Horton opened an unassuming factory in Haverhill, for the manufacture of flexible innersoles. Nobody paid much attention to the concern in the beginning, as innersoles had been made long before these men entered business, and with no marked success. Starting with a capacity of about 12,000 pairs per day, the company began its "battle of business" by offering the shoe manufacturer a superior sole backed by real service. From then on the George H. Webster Sole Company took the lead in the manufacture of its special commodity, and, to serve the manufacturer of shoes better, opened branch offices in Haverhill, Brooklyn, St. Louis, Milwaukee, Toronto, Can., and London.

After fourteen years in business, the company is making over fifteen million pairs of innersoles yearly, at its great plant at Athol.

The concern employs 100 operatives and the partnership is made up of George H. Webster and Oscar L. Horton.

NEW ENTERPRISES IN THE "LEE SHOPS"

When the "Lee Shops" became idle as the result of the liquidating of the Lee Brothers Company, the Athol Industrial Corporation was formed, several hundred local citizens subscribing to the stock of the concern, and the large plant was purchased and manufacturing quarters leased to new concerns.

The Ansin Shoe Manufacturing Company with capital of \$50,000, took over a part of the factory and began with seventy-five employes, which total was later increased to 300, the number now on the rolls. Frequently it has operated up to 10 o'clock at night and on Saturday afternoons during the past three years, and now occupies an entire floor of the building. A. B. Ansin is president, and S. D. Ansin, treasurer and secretary. The corporation maintains a Boston office at 74 South Street.

The Merit Shoe Manufacturing Company of Lynn, Inc., removed to Athol, from Lynn, and leased 18,000 feet of floor space, employing at the outset more than one hundred operatives, in the manufacture of women's McKay footwear. The partners are Max Goldberg and Samuel Uchitel. Today 200 operatives are employed.

The Marston & Tapley Company, formerly of Danvers, with capital of \$50,000 employs upwards of two hundred twenty-five operatives in the manufacture of shoes, in the Lee factory. George D. Pike is president, J. M. Barton, vice president, and F. A. Pike, treasurer.

The Taylor Box Company, owned by J. W. Taylor, is another tenant of the Lee factory and it is estimated that the combined payrolls of these four new industries are greater than those of the Lee Brothers Company in the heyday of its existence.

The Athol Pump Company owned by the Leavitt Machine Company of Orange, manufactures pumps and plumbing supplies, and the Athol Comb Company, a partnership made up of Milton Alkan and Gilbert Shulman, produces celluloid goods, and employs 250 operatives.

The Boston Fibre Company, Inc., operates one of its two Massachusetts factories, in Athol, where felts and bats are produced and George Gerry & Son, owned by R. M. Gerry, manufactures textile machinery.

The Athol Table Manufacturing Company, whose plant was formerly located in South Athol, in 1929 purchased the factory previously owned by the Diamond Match Company and manufactures kitchen tables, breakfast sets and novelties. It employs thirty hands, and has capital of \$85,000. Herbert B. Hadley is president; Fred C. Valiton, vice president; Walter N. Hadley, secretary and George H. Hadley, treasurer. The corporation is associated with the F. W. Lombard Company of South Ashburnham.

In 1928, J. Warren Moulton and his son, John W. Moulton, who had carried on textile operations as the Moulton Manufacturing Company in Rutland, for thirty years, found their property taken over by right of eminent domain, and their water rights absorbed by the Commonwealth of Massachusetts, in the extension of the Metropolitan Water System, and they purchased the two-story brick factory, in Athol, erected by the late Thomas Goodspeed, about forty years ago, where he carried on silk manufacture. He was succeeded by D. E. Adams, who operated it for twenty years under the name of the Adams Silk Company, Inc. In 1927 the Corticelli Silk Company, of Florence, purchased the assets of the Adams unit, and removed the machinery to its other plants.

J. W. Moulton & Son, Inc., installed modern textile machinery including automatic looms, and employs fifty operatives. More than fifty per cent of the power used at the plant is derived from the water power facilities at the site. John W. Moulton, Jr., is president and secretary, and J. Warren Moulton, is vice president and treasurer.

AUBURN MANUFACTURES

Approximately one hundred years ago, Charles Richardson built a yarn mill at Pondville, in the town of Auburn, and later employed water-power at Otis Pond, where he set up a satinet plant. In 1862, B. F. Larned entered the firm and was the sole owner when the mill was destroyed by fire, in 1865. A new factory erected on the site was burned in 1870, and another suffered a like fate ten years later. A new mill was built and in 1883 was

purchased by L. J. Knowles & Brother, the plant later being known as the Auburn Woolen Mill.

Nearly a hundred years ago a four-story paper mill was built at Stoneville, but it was swept away by a flood in 1856 and was never rebuilt.

In 1834 Jeremy Stone erected a brick mill on Young's Brook. Later the title passed to Edward Denny, of Barre, and, in 1850, to A. L. Ackley, who changed the product from woolen to cotton. From 1858 to late in the last century, it remained in the Smith family until it was taken over by the Stoneville Worsted Company.

In 1860 Auburn had two cotton mills, with 4,000 spindles, in which 840,000 yards of cloth were woven annually.

In 1901 the Pondville Woolen Company was incorporated, with capital of \$50,000, and manufactures shirting flannels, and men's and boys' suitings, the plant being located on the fifth water privilege on the Ramshorn stream. Ninety hands are employed, and the plant is equipped with 2,016 woolen spindles, seventy looms, six sets of cards, and complete dyeing and finishing departments. L. B. Rhodes is president; H. I. Rhodes, treasurer; L. J. Rhodes, secretary, and G. M. Rhodes, agent. The corporation has capital of \$50,000 and maintains a New York office, at 75 Worth Street.

The Auburn Worsted Company, incorporated in 1917, operates the Ettrick Mills, and produces weaving and knitting worsted yarns. The plant is equipped with 4,000 worsted and 500 twist spindles and employs 100 hands. C. L. Gagnetin is president and treasurer of the corporation, which has capital of \$100,000.

The Worcester Rendering Company employs eighty operatives in the manufacture of tallows and fertilizers, the concern being a subsidiary of the Consolidated Rendering Company of Boston. James E. Fish is the local manager.

BARRE—THE HOME OF THE YANKEE HORSE RAKE

Barre owes much of its industrial development to the foresight and genius of Phineas Heywood, who, as early as 1810, conveyed land and water rights for manufacturing purposes.

In addition to grist and sawmills, Parker & Pratt established a tannery, while Heywood began the erection, in 1810, of a clothier's mill, which continued to operate, with changes adapted to the various eras, until about 1870, at which period yarn and coarse woolens were turned out. Of an inventive turn of mind he evolved a cotton-spinning machine about 1814, and a woolen-spinning machine two years later, and in 1827 he erected a larger mill.

About 1830 a company purchased rights on the Ware River and erected a brick factory for the manufacture of woolen cloth and in the winter of 1857-58 it was burned, but another of the same dimensions, 82 by 44 feet, four stories in height, was built the following summer. In 1880 the plant was bought by the Ware River Woolen Company but three years later it was destroyed by fire.

About 1825 Benjamin Clark erected a brick factory which was later taken over by a corporation known as the Boston & Barre Manufacturing Company and was later burned, but John Smith purchased the land and water privilege, and built a new mill which he operated until his death, in 1859, when his sons succeeded to the business.

In the days when palm-leaf hats were in vogue, Barre produced in one year (1837) products of that type, valued at \$167,200.

THE CHARLES G. ALLEN COMPANY

Barre takes rank as "the birthplace of the Yankee horse rake," for the town early assumed its place in implement history when S. R. Nye invented a horserake during the early sixties, while about ten years later Charles G. Allen, of Barre, and C. M. Luffin placed upon the market a much-improved invention, and E. W. Bullard invented a hay-tedder. From Mr. Allen's original invention has grown one of Barre's major industries—the Charles G. Allen Company—which employs 200 hands in the manufacture of ball-bearing drilling machines, agricultural implements and grey iron castings, the plant having been greatly extended in recent years by Hon. Harding Allen, the present owner.

At White Valley are located the White Valley Mills, a branch of Nelson D. White & Sons, Inc., of Winchendon, where cotton denims are produced, the plant being equipped with 4,500 ring spindles and 128 looms.

The T. E. Rich Company manufactures sash and blinds, at its Barre Plains plant, and employs thirty-five operatives. Lewis E. Rich is president and Charles T. Rich, treasurer and secretary.

THE LORD BARNBY INDUSTRIAL ENTERPRISES, AT SOUTH BARRE

South Barre has remained the industrial center of the town, and perhaps the reason may be found in the fact that when Sir Francis Willey, of Blyth, near Bradford, England, came to the United States, early in the first decade of the present century, seeking a location for an American branch of his extensive English textile enterprises, he made exhaustive and painstaking examinations of localities where adequate water-power facilities existed, and finally selected the South Barre location because there he found the waters of the Ware River so pure as to be peculiarly adapted to the washing and cleansing of wool.

He immediately bought the Wadsworth Woolen Mills, incorporated the Barre Wool Combing Company, in 1903, with capital of \$1,500,000, greatly enlarged and modernized the plant, and began wool combing. In 1929 another substantial addition was made to the plant.

Five years later he incorporated the Nornay Worsted Company, with capital of \$250,000, to manufacture worsted yarns, and later Francis Willey & Company, Inc., which is engaged in the production of wool tops.

Francis Willey, the first Baron Barnby of Blyth, started life as an apprentice to his father, who was a Bradford, England, wool merchant. At twenty-one the future peer was admitted to the partnership, and two years later he succeeded to the management. Some years later the firm was converted into a stock company under the name of Francis Willey & Co., Ltd., with headquarters at Bradford, and branches in London and Boston.

Francis Willey was raised to the peerage in 1922, being the first member of the woolen industry of England to enter the House of Lords. He made periodical visits to the United States, his last taking place in 1927. On February 16, 1929, he died at his residence, Blyth Hall, Nottinghamshire, at the age of eighty-nine years, lacking four days, falling a victim to influenza.

Up to the end of his life, he remained active in the concerns with which he was identified in England, Barre, and in Poland, where he also owned a mill, and retained his seats on the directorates of the various enterprises.

His son, Col. F. Vernon Willey, who succeeded to the title, had a distinguished war record, is a member of the board of directors of Lloyd's Bank, and has sat in the English Parliament as a Conservative.

Fortunate indeed it was that South Barre was selected as the habitat of Lord Barnby's three American concerns, as he did more than merely establish manufacturing plants. A firm believer in having his employees properly housed and afforded every possible advantage he early set about at the beginning of this century to provide neat and attractive homes, a park, a clubhouse, hotel facilities and everything that goes to make employees contented and happy.

Other property owned by him in the village included stores, a theater, two hotels, and the post office building. He gave the Episcopal Church, in South Barre, to the diocese, and the land on which St. Thomas' Roman Catholic Church stands was presented by him to the Bishop of Springfield.

The three Willey enterprises carry physical equipment which is valued at a figure that makes the concerns in the aggregate the payers of fully fifty per cent of Barre's total annual municipal tax levy.

Here again is found concrete and indisputable evidence that Massachusetts offers as favorable advantages to textile enterprises as any part of the United States. Lord Barnby had the choice of locating his corporations anywhere in the United States, but he chose South Barre, and that decision was responsible for the rehabilitation of a village, which, at the beginning of this century, was decadent and little more than a ruined mill hamlet with no future, but which soon became a flourishing and prosperous community, where the families of more than six hundred fifty employees reside today.

Barre has been proud of the fact that it is the only town or city in Massachusetts where a future member of the English House of Lords established three manufacturing units, and when the memorial to the World War veterans was dedicated at South Barre, Lord Barnby's son was invited to deliver the dedicatory address, and despite the fact that he served with distinction throughout the struggle, with the British Army, his name was added to the list of the sons of Barre, whose patriotism is there recorded.

The three corporations have their executive offices at 300 Summer Street, Boston, and branch offices are maintained in Philadelphia.

Harold S. Edwards is treasurer of the three Barre enterprises.

BLACKSTONE'S MANUFACTURES

About 1804 the Blackstone Manufacturing Company built a dam on the Blackstone River, at Blackstone, and five years later erected a cotton mill. In 1825 Welcome and Davies B. Farnum built a satinete factory.

The Saranac Mills, of the American Woolen Company with 4,312 spindles and 180 looms today manufacture fancy and piece dyed worsted and woolen products, and in 1928, the East Blackstone Knitting Company completed a one-story mill, 30 by 52 feet, and started the manufacture of knit goods, operating by electric power. The plant was burned late in the summer of 1929.

AN EARLY BROOKFIELD ENTERPRISE

In the *Boston News Letter* of October 6, 1768, appeared this item: "We hear from Brookfield, that Mr. Joshua Upham, of that town, a gentleman of the law, and his two brothers, with a number of other gentlemen, have lately erected a building, 50 feet in length and two stories high for a manufactory-house, and are collecting tradesmen of several sorts for the woolen manufactory, and they propose to keep a large number of looms constantly at work."

Thus it appears that soon after the middle of the eighteenth century textile manufacture was under way in Brookfield.

TRANSPLANTING GUMMED AND COATED PAPERS FROM SCOTLAND
TO BROOKFIELD

Many years of experimentation and much hard work were involved to bring gummed papers to their present point of perfection, and more than a century ago, two Britishers began to turn out the product in the old country. One was named McLaurin, and the other was named Jones. Both were competitors, and for many years they imported into the United States from Great Britain nearly all the best quality of gummed papers.

At the McLaurin plant in Scotland, the first machine ever used to gum and coat paper in the roll was invented and installed. It was built of wood and contained a huge circular revolving brush, surrounded by a number of small circular revolving brushes on the sun and planet system, thus following the method then in use, of hand coating; all paper being gummed or coated in the sheet by hand, with a circular motion.

Following the introduction into this country of the non-curling gummed papers, the local demand for the product increased by leaps and bounds and to meet it, as well as to avoid export problems, the McLaurin concern decided to form an American corporation, and the first unit was established at Brookfield, in 1906, under the name of the Ideal Coated Paper Company. Later, the Samuel Jones Company began manufacturing in Newark, N. J.

The growth of the Brookfield concern was such as to make it desirable to build a new coating mill, and a branch factory was erected at Ware, under the name of the Ware Coated Paper Company. In 1922, the United States plants, established by the McLaurin and Jones concerns, were merged, when the Ideal Coated Paper Company of Brookfield, and the Ware Coated Paper Company of Ware absorbed the Samuel Jones Company, of Newark, N. J., and formed the present McLaurin-Jones Company, with headquarters in Brookfield, and with capital of \$894,400, since increased to \$908,000.

The Newark plant was sold and all manufacturing operations are carried on at Brookfield and Ware.

Today, the McLaurin-Jones Company stands foremost among manufacturers of gummed and coated paper and gummed cloth.

At the Brookfield mill all kinds of high class gummed papers and cloths, both flat and roll stocks are manufactured, the lines including sealing and veneer tapes, flat gummed papers, glassed, box stays, tablet and ticket stock, binding, cambric and hollandes.

At the Ware mill coated and glazed papers are produced, including white, fancy, gold and platinum, box coverings, label papers, postcard, greeting card, liners, blotters, cover and plated papers, coated lithographic and proofing, brush, label and band papers and coated specialties.

The United States and export sales are handled through the main office at Brookfield, and its branches. The mills are running full time and have been for years.

William McLaurin is president; L. A. Bassett, secretary, and John McLaurin, treasurer of the corporation.

THE GAVITT MANUFACTURING COMPANY

In 1923 the Gavitt Manufacturing Company was incorporated, with \$25,000 capital, and its original plant, in West Brookfield, was equipped with 650 braiders, and employed twenty-five operatives in the manufacture of radio and tinsel cords, E. T. Gavitt being president, and L. E. Gavitt, treasurer and general manager.

In 1928, the corporation purchased the plant formerly used by Daley Brothers, shoe manufacturers, the removal being required by the growth of the Gavitt concern, which was unable to secure sufficient additional space in West Brookfield.

The Brookfield shop, of four stories, affords the company 24,000 square feet of floor space, triple the available room in the West Brookfield factory.

Half of the production is of telephone cordage for regular telephone equipment, and cords for loud speaker radios. The other half consists of insulated wire and special cable assemblies used by radio set manufacturers.

The slipper department of the company is carried on in the Brookfield factory, one floor being devoted to this type of production.

THE MANUFACTURES OF CHARLTON

As early as 1793 two tanneries existed in Charlton, one owned by Capt. Israel Waters, and the other by Asa Corben, the former being provided with water-power.

The Charlton Woolen Company was founded by Edward Akers, who built a small mill on Spring Brook. Half a mile away was another small plant on Cady Brook, owned by Mr. Norris, and after several years of successful operation, the two plants were combined, under the partnership name of Akers & Norris. Ultimately, the senior partner became the sole owner, later admitting his son-in-law, Frederick S. Taylor, to the firm of Akers & Taylor. In the interest of economy of production, the carding spinning and weaving were moved to the Spring Brook Mill, and the finishing and dyeing were concentrated in the Cady Brook plant, and the same policy is followed today by the Charlton Woolen Company which was incorporated in 1912, the Akers & Taylor properties having been purchased four years before by Harry W. Goddard, W. S. Kilton and H. G. Grimwade.

The company now produces about a million yards of cloaking a year, valued at \$750,000, and in addition it manufactures overcoatings and suitings, and the plant is equipped with eleven sets of cards, 106 narrow looms, 3,696 woolen and 200 twist spindles, complete dyeing and finishing departments, four boilers and a water wheel. The company employs 180 opera-

tives, and has capital of \$50,000. W. G. Hall is president; R. M. Grimwade, treasurer and M. Grimwade, secretary.

In 1902 the Aldrich Manufacturing Company was incorporated, and manufactures satinets. The plant has three sets of cards, twenty-four broad looms, 912 spindles, dyeing and finishing departments, one boiler, and one water wheel and employs sixty operatives.

Thomas Ashworth is president; Mary Ashworth, secretary, and James Ashworth, treasurer.

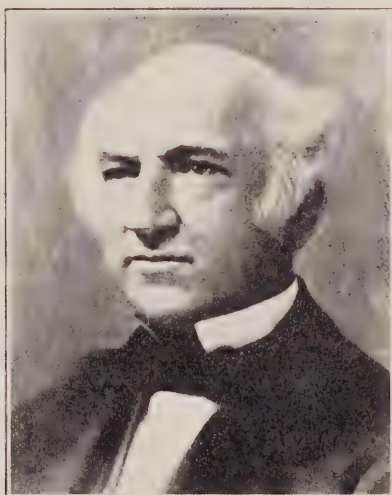
A. F. Putnam, of Oxford, operates under the name of Putnam Brothers, a wooden box plant, at Charlton, where twenty men are employed.

ERASTUS BRIGHAM BIGELOW—THE MOST VERSATILE INVENTOR THE COMMON-WEALTH HAS YET PRODUCED

At first blush many men and women regard mechanical ideas of small importance, compared with those which are moral and spiritual, yet analysis reveals the indisputable fact that the great advance made by the human race during the last 100 years is largely attributable to discoveries in mechanics.

The products of American inventors have added immeasurably to the comforts of mankind. They have afforded the leisure necessary for progress in the higher and spiritual things of life, and they have provided the funds requisite to amplified educational, religious, and philanthropic movements.

It has been said of Erastus Brigham Bigelow that, perhaps more than any other American, he influenced the entire development of the textile art.



ERASTUS BRIGHAM BIGELOW
of Clinton

Inventor of the power carpet loom

While his career is of vital interest to the citizens of the United States, it is of especial significance to the residents of Massachusetts and of the town of Clinton, because he is one of the most important personages yet

recorded by history in the Commonwealth, and without question the most influential character that ever trod the streets of Clinton, where he lived and acted. Lacking his activities, the Clinton of today might still remain an almost unheard of town, since he alone gave birth to the ideas which lie at the basis of its industrial prestige.

Born in West Boylston, April 2, 1814, in a dwelling on Temple Street, which is still standing, the son of a farmer, wheelwright and chairmaker, who ultimately became a cotton manufacturer in the days when cotton mills were uncommon enterprises, he attended the primitive schools of the period a few weeks each year, worked on a farm, constructed a chair of novel pattern, made many improvements in farming tools, was employed in his father's cotton mill, and, to eke out more money for further schooling, played the violin at dancing parties until the early hours of the morning. At the age of fourteen he invented a hand-loom for weaving suspender webbing.

On April 3, 1914, the *Brockton Times* paid this tribute to the genius of the inventor:

"Today is the centenary of the birth of Erastus Brigham Bigelow and though there is no ringing of bells and the school children are not reciting verses and singing songs, the day is being fittingly celebrated. Millions of men, Christian, heathen, black, white and yellow, in every corner of the world are wearing elastic suspenders and that is tribute enough to Bigelow, the inventor. * * * The hundred variations of the 'gal-lus,' including the modest garter, all are fruits of Bigelow genius, at least as far as material is concerned, for it was the Bigelow loom that created them."

Taking a ball of "piping cord" which was brought into his home, and learning that it was made by hand in a rope walk he had in operation within two months thereafter a machine which made piping faster and cheaper than ever before and the fruits of which netted him \$100.

When sixteen years of age he had saved enough to enable him to enter Leicester Academy, where his teacher recommended a college course. But his father being opposed to the idea, young Bigelow trekked to Boston, where he became dry goods clerk for S. F. Morse & Co. Interested in stenography, he mastered the subject without a teacher, and wrote a book on shorthand, entitled, "The Self-Taught Stenographer," which was published by Carter & Andrews, of Lancaster, and which met with a ready sale, in Boston. Thus encouraged, he entered into partnership with another young man, enlarged his field of operations, and not only lost all his savings, but found himself several hundred dollars in debt.

At eighteen, he joined with J. Munroe in the manufacture of twine in his father's cotton mill at West Boylston, but the unfortunate financial affairs of the owner forced the partners to remove to Wareham, where Messrs. Bigelow & Munroe unsuccessfully attempted to manufacture cotton goods.

His next essay was in New York, where he took lessons in penmanship and subsequently taught the art there and in New Jersey.

Receiving the consent of his father, young Bigelow resolved to study medicine, and began his preparatory work at Leicester Academy, entering a medical school a year later and remaining until he resolved that he must have more general education as a basis for his professional studies.

THE GERM OF THE POWER LOOM IS FOUND UNDER A MARSEILLES QUILT

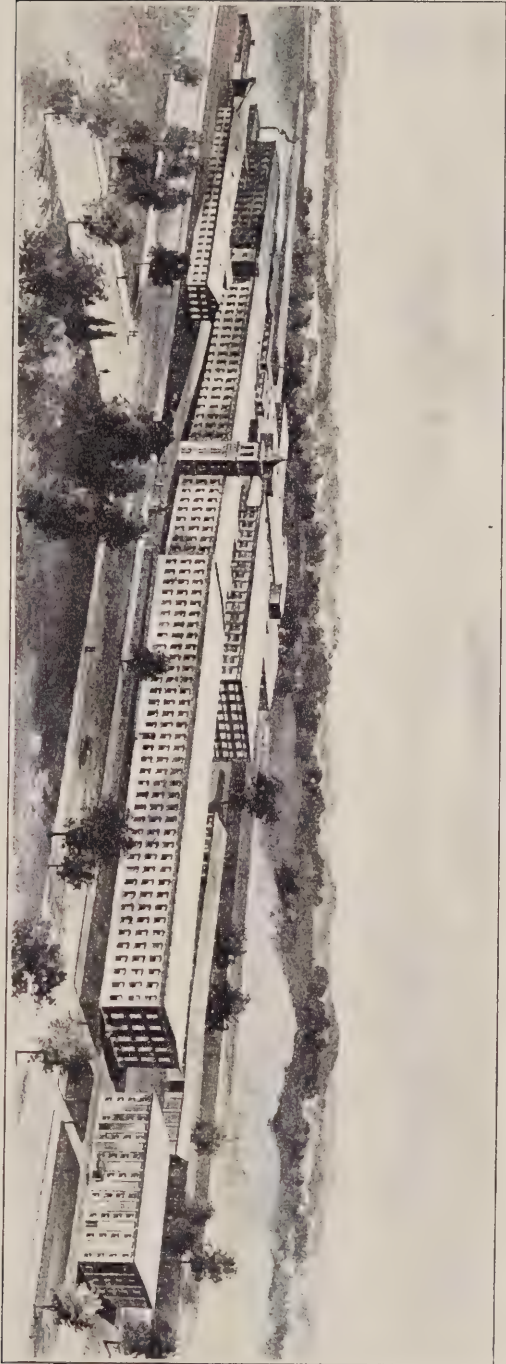
And then came the turning point of his life, and here again one finds a demonstration of how a seemingly trivial incident in the life of a genius may influence the future of countless millions and materially change the course of a nation.

Erastus B. Bigelow chanced to sleep one night under a Marseilles quilt, and as he carelessly drew his hand across the fabric, the thought came to his mind of the slow and costly process involved in the weaving of the coverlet on a hand-loom. He recalled that he had seen such looms unsuccessfully operated in West Boylston. He asked himself, "was it within the ability of man to invent a loom that could operate by power, and thus lessen the labor involved in the hand process?" Then and there the die was cast, and he could scarcely await the coming of dawn to set himself at work. Within a short time he had invented an automatic loom for weaving knotted counterpanes. Freeman & Cobb, of Boston, appreciating its worth, agreed to secure the patents, carry on the manufacturing, and give him one-fourth of the profits. He now saw an opportunity to finish his education, but he was again destined to disappointment, as the Boston firm failed in the panic of 1835-37 and his artificial profits were *non est*.

Undaunted, he turned his attention to the production of coachlace, by power. While teaching penmanship in New Jersey, he had seen this fabric laboriously woven by hand. Hiring a farmer's work horse and a yellow bodied chaise, he visited the carriage makers of Worcester, Grafton, Framingham, Medway and Dedham, all of whom referred him to Fairbanks, Loring & Co., of Boston, dealers in such fabrics, who felt such a loom would be a success despite the fact that a similar device had been considered by lace makers and declared to be impossible of accomplishment. He returned to West Boylston, with a yearning to gain permanent success in the field of American invention. He was now approaching the age of twenty-five; he had tried many lines in his attempt to gain an education; his family and friends were justly apprehensive about him, but as he analyzed his situation he realized that he had gained a fair degree of general discipline; that he had acquired the power of expressing himself in clear, forceful, and understandable English; that he possessed a sufficient knowledge of mathematics and of the natural sciences to serve his needs as an inventor; that he had gained self-reliance and had learned something of human nature as well as of the art of dealing with men, through his contacts with the world.

In his career the past had been but a period of preparation for the future in which he was to elaborate his accomplishments. So absorbed did he become in the immediate problem in hand that the story is told of his showing a visitor from his home by taking an unlighted candle and silently leading the groping, stumbling guest through a long, dark hallway, opening the door, and returning to meet, with an unconscious stare, the laughter of the entire family. His sanity began to be doubted by those closest to him. Yet for forty days he pondered on his invention with no guide or help save a piece of hand-made coachlace, and then there emerged from his brain a loom for weaving coachlace by power.

Seeing this invention at work one would wonder at the precision of its motions, and the study that must have been made by Bigelow, then



WORSTED YARN PLANT OF THE BIGELOW-HARTFORD CARPET COMPANY, CLINTON

twenty-four years of age, and a young man who had not even so much as looked between the covers of a treatise on mechanics.

When one considers that this invention embodied many of the fundamental principles of his later triumphs, and naturally paved the path they subsequently traversed, and then recalls that these devices are to-day affording employment to thousands upon thousands of men and women and adding to the comforts of countless millions throughout the world, one may appreciate that this period was all important, not only in the career of the inventor, as an individual, but also in the history of civilization.

Appleton's "Dictionary of Mechanics" thus described this notable invention: "The figure on coachlace is produced by raising on the surface of the ground cloth a pile similar to the Brussels carpet, formed by looping the warps over fine wires which are inserted under such of the warps as have been selected by the jacquard to determine the figure. The warps are then woven into the body of the cloth to tie and fix the loops. The wires are then withdrawn and reinserted. Automatic pincers, as if instinct with life, grasp the end of the wire, draw it out from under the forward loops, carry it back toward the lathe, where the warps are spread apart, forming what is called the open shed and then introduce and drop it, that the shed may be closed and opened, that by the throw of the shuttle, the weft-threads which are to tie and weave the warp-threads into the cloth may be beaten up by the reeds. The pincers then move back to draw another wire from under the formed loops and repeat the same operation, several such wires being at the same time in the cloth to prevent the loops from being drawn out by the tension which is given on the warps to insure an even and regular surface to the fabric; but, as there are a number of these wires woven into the cloth, nearly touching one another, it becomes a matter of great difficulty to contrive a mechanism which insures the taking of only one of these wires to draw it out, and the selecting of the proper one at each operation. The pincers could not properly be made so narrow and work so accurately as to insure this. This difficulty is overcome by an ingenious mechanism placed on the opposite side of the loom, which at each operation selects the required wire, and pushes it, gripped sufficiently far beyond the ends of the others, to bring it out by the fingers, which then draw it out, to carry it back and introduce it in the open shed of the warps."

HE PROFITS BY HIS EARLY FAILURES

Erastus B. Bigelow had not forgotten his sad experience in allowing his counterpane loom to escape him, and he turned to his elder and only brother, Horatio N. Bigelow, to put into successful operation this new child of his brain. Horatio had been overseer in his father's cotton mill, and, for two years was in charge of the weaving room, at Beaman's Mill, in West Boylston. In 1836 he became superintendent of a cotton mill in Shirley.

Fortunately for the Lancaster "Factory Village," the hard times had destroyed the confidence of cotton manufacturers, and, Nathaniel Rand and Samuel Damon, who held the title to the so-called "Yellow" mill, which is still standing in the yard of the Bigelow-Hartford Carpet Company's plant, at Clinton, serving as a storehouse and where it is daily passed

by thousands of tourists who journey over one of the automobile routes between Clinton and Worcester, were pleased to lease it to the Bigelows. Here they set up the first loom, the elder brother furnishing what capital was forthcoming, and on March 7, 1838, Horatio N. Biglow, John Wright, of Worcester, and Israel Langley, of Shirley, were granted a charter, under the name of the Clinton Company, to manufacture cotton, woolen and silk goods and machinery, the capital stock not to exceed \$100,000, of which \$30,000 might be invested in real estate. The title of the corporation was selected by E. B. Bigelow, who, while in New York City, had registered at the Clinton House, named in honor of Gov. De Witt Clinton. "Factory Village" soon became Clintonville, and, in 1850, it grew into the town of Clinton. During the first year of operation, consignments of coachlace were made to Fairbanks, Loring & Co., of Boston, amounting to \$9,000, but the construction of looms was the main business during the first two years. From 1845 to 1848 the average profits were 12½ per cent, annually, and in the former year a capital increase of \$200,000 was authorized. A spinning plant was opened by the company at Sawyer's Mills, in Boylston, in 1846 and the capital was further increased to \$500,000, in 1848.

Miss Zoa Lawrence, who afterward became Mrs. Robert S. Freeman, was the first girl weaver employed in the plant of the Clinton Company, and as such wove the first yard of coachlace ever produced for commercial purposes on a power loom in the United States. The company was successful and operated until January 1, 1851, when William H. Horstman & Co., of Philadelphia, purchased all the looms in the Clinton plant for \$30,500, and removed them to Pennsylvania. A report rendered October 23, 1854, showed that these looms had produced in the five previous years coachlace valued at \$391,894.

In 1850 thirty-six looms were in operation in the Clinton factory, producing 70,000 counterpanes, 10 by 13 quarters in size, annually, while the plant was assessed for \$110,000. The invention reduced the price of counterpanes from \$9 to \$3.

Nothing succeeds like success. Following the hard times, the firm of Freeman, Cobb & Co., had recovered from its financial ills, and when one of its members sought a renewal of the contract with E. B. Bigelow, he informed him that he had seen a counterpane much superior to the knotted type and advised that the agreement be abandoned. Bigelow set about to invent a power loom that would weave the new form, and sold the patent on royalty to Hugh R. Kendall. In 1848 the Lancaster Quilt Company was incorporated, with \$200,000 capital, to manufacture the new type of counterpane, and for seven years, Horatio N. Bigelow was agent of the concern, which employed 100 hands and produced annually quilts valued at \$150,000.

HE WORKS ON THE PROBLEM OF THE INGRAIN CARPET LOOM

In 1860 Erastus B. Bigelow made the statement that from the early part of 1839 to late in 1860, his mind and his time were largely occupied with the invention and perfecting of his ingrain carpet loom, with which his name was more prominently associated than with any other, save the Brussels carpet loom, with which the other invention is so often compared.

In 1860 he applied for the extension of his most important patent

on the ingrain carpet loom, the specifications *being printed in a bulky volume of between 500 and 600 pages*. He had entered into an agreement with the Lowell Manufacturing Company in 1839 by which he was to give his time to perfect this invention. By its terms he was to construct a trial loom and, in the event of his success, the company was to erect a mill for his looms, and pay him a royalty on all that were built and installed.

His problem was that of making iron think. The figures must match, there must be a perfect selvage, and a smooth, even face on the product. The hand-loom weaver could meet all these practical difficulties by exercising his judgment. He could pull the weft thread to make the selvage even if the shuttle had executed its work imperfectly; he could increase or decrease the force he put into the lathe if the figure appeared too long or too short, and he could make the fabric smooth by regulating the tension of the warps. But how could cold iron be educated to do these things? Mr. Bigelow provided the answer and invented a two-ply carpet loom that wove twelve yards a day of carpeting of a quality far superior to that of the hand-loom, which could weave but eight. He soon produced a second loom, which wove eighteen yards a day, and, finally, a third, which brought the yardage to over twenty-five a day. He then produced a three-ply loom, which produced between seventeen and eighteen yards of carpeting a day. His first patent on these was issued in May, 1842; the next, and most important, in February, 1846, and the next, in October, 1849. Automatically the price of carpetings fell twenty per cent and the importation of these commodities was practically suspended.

By 1843 E. B. Bigelow appeared to possess a monopoly, as an inventor, in applying power to the weaving of figures fabrics, and he was approached by a group of capitalists to plan a mill, advise upon its construction, and equip it with suitable machinery for more complex patterns.

HE INVENTS A GINGHAM LOOM THAT REVOLUTIONIZED THE COTTON INDUSTRY

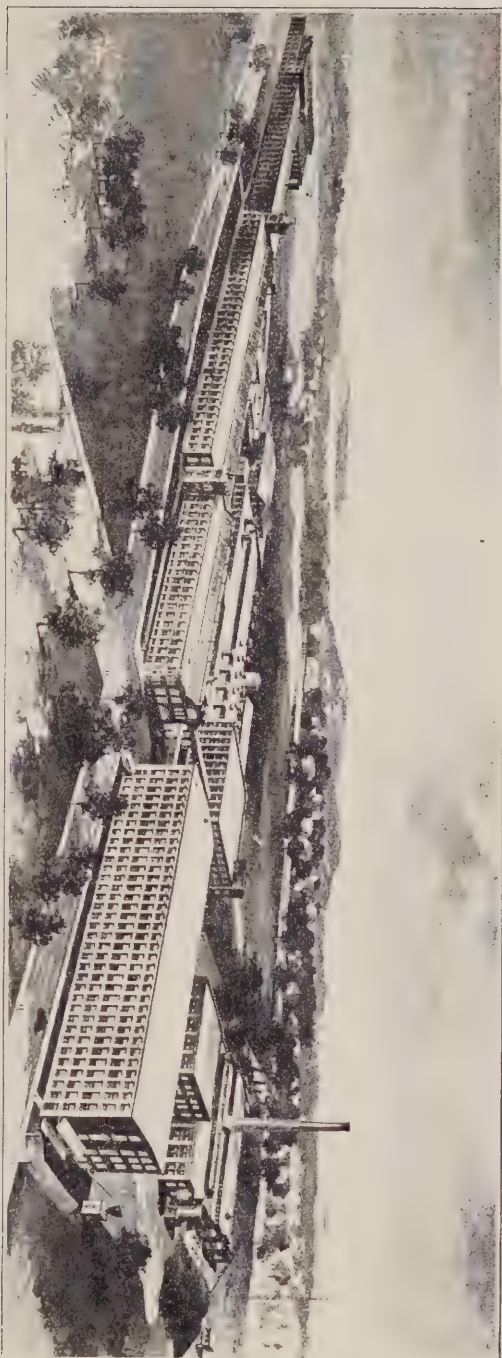
On April 10, 1845, Erastus B. Bigelow was granted a patent on an invention which was to revolutionize the manufacture of gingham almost as materially as his previous devices had altered the carpet industry.

It provided for the production of plaids, and really overhauled and modernized the processes then in vogue from beginning to end. Three patents were granted to him, in 1846, on loom-templers and speeders-fliers.

Mr. Bigelow's first gingham loom ran 100 picks per minute, and notwithstanding the vast improvements that subsequently took place, all of the original looms installed by him, in the Lancaster Mills, during the '40s, remained in service until 1887.

HIS GREATEST INVENTION—THE BRUSSELS CARPET LOOM

Then came the crowning work of the career of Erastus B. Bigelow—the invention and development of the Brussels carpet loom, the germ of which was found in the coachlace loom. He made his first application of the new invention to the weaving of Jacquard Brussels carpets, at Lowell, in 1845, took out the English patents, in March, 1846, and those in the United States, beginning in 1848. During the next three



WEAVING MILLS OF THE BIGELOW-HARTFORD CARPET COMPANY, CLINTON

years, patent after patent followed, bearing on the details of this invention. In after years he told a friend that the main outline occurred to him while riding on a train, in Europe. He had become satiated with sight-seeing and "an irresistible fit of invention came over him, and withdrawing himself from the outer world, the machine soon assumed power before his mind's eye." The details were laboriously wrought in the machine shop and mill.

In 1851 he had brought the loom to such a state of efficiency and perfection that the jury of awards at the London Exposition, that year, promulgated the following statement: "The specimens of Brussels carpeting exhibited by Mr. Bigelow are woven by a power loom invented and patented by him, and are better and more perfectly woven than any hand-loom goods that have come under the notice of the jury. This, however, is a small part of their merit, or rather that of Mr. Bigelow, who has completely triumphed over the numerous obstacles that presented themselves, and succeeded in substituting steam power for manual labor in the manufacture of five-frame Brussels carpet. Several patents have been taken out by different inventors in this country for effecting the same object; but as yet none of them has been brought into successful or extensive operation, and the honor of this achievement, one of the greatest practical difficulty as well as of great commercial value, must be awarded to a native of the United States."

The London *Morning Chronicle* said: "At the eleventh hour, power loom manufactured Brussels was deposited in the American division, the merit of the invention and application of this important discovery being due to Mr. E. B. Bigelow, of the United States. The evidence of the successful application of a much-wished-for invention is all that could be desired. Although various attempts have been made to adapt the power loom to carpet weaving in this country, there is not, we believe, at this moment, any machinery perfected for that object. Our American brethren have, therefore, gained another step ahead of us and have won another laurel on this well-contested field of the industrial arts."

The United States Government report of the London Exposition was to this effect: "Toward the close of the exhibition, Mr. Bigelow, of Boston, exhibited several specimens of Brussels carpeting made by the power loom, which excited much attention. The process, invented and patented by Mr. Bigelow, and now in general use in the United States, is altogether unknown here. It is, perhaps, one of the greatest improvements yet made in weaving, and accomplishes what has hitherto been deemed an impossibility, viz: The use of all varieties of color in the power loom."

The patent rights for the United Kingdom were sold to Crossley & Sons, of Halifax, England, and J. B. Parker and James Otterson took a loom from Clinton to that country and from this as a model the castings were made and looms were constructed abroad.

In 1848 Mr. Bigelow evolved the mechanical device known as the Wilton loom, involving the looping and cutting of the velvet pile to produce the now famous Wilton carpet.

HE PRODUCES A POWER LOOM TO WEAVE WIRE CLOTH

Next followed Mr. Bigelow's invention of a power loom for weaving wire cloth, and this led to the establishment in his adopted town of the Clinton Wire Cloth Company, in 1856, which concern was absorbed by

the Wickwire-Spencer Steel Corporation, and is now operated by that unit.

His looms for weaving tapestry carpets, although differing somewhat from those for Brussels, were closely associated with the latter, in the mind of their inventor. In 1851 looms invented by him for weaving silk brocatel were put into operation at Humphreysville, Conn., and belonged to his series of power looms for weaving figured fabrics. They successfully produced fabric for fifteen cents a yard fully equal in texture to that made on hand looms at Lyons, France, at a cost of sixty cents a yard.

Thus we find Erastus Brigham Bigelow being awarded upwards of fifty basic patents on power looms for weaving coachlace, counterpanes, ingrain carpeting, gingham, and other plaids, Brussels and Wilton carpeting, tapestry carpeting, silk brocatel, and wire cloth, to say nothing of auxiliary and subordinate inventions—all stamping him as without doubt the most prolific mechanical genius of the nineteenth century. The magnitude and far-reaching influence of his inventions on labor are emphasized in an article he wrote for the *Atlantic Monthly*, of October, 1878, in which he made the statement that "One woman can weave as much Brussels carpeting by the carpet power loom, as ten men assisted by ten boys, can weave by the hand loom. To weave by the hand loom the carpeting that is now woven by the carpet power loom in its various applications would require the labor of 14,000 more persons than are now employed." It must be recalled that this statement was made fifty years ago, and it is surely no exaggeration to say that Erastus Brigham Bigelow, through his mechanical genius, accomplished in the industrial world more work than a quarter of a million operatives do by brain and muscles in their lifetimes.

AN ANALYSIS OF HIS WONDERFUL INVENTIONS

To fully appreciate the magnitude of his contribution to the textile art, one must remember that prior to his appearance as an inventor only plain fabrics, or those carrying comparatively simple figures, were woven on power-looms. In the wake of his patents there are few, if any, of the complex and beautiful textures which are still wrought, or which have ever been executed by patient and skillful toil on the hand-loom, to which his rapidly moving machinery has not been or may not be applied.

It is readily apparent that the numerous and intricate requirements of an art embracing process so varied and involved, could not be met by a single invention, and of the two score and a half patents taken out by Mr. Bigelow in this country, the larger part were directly connected with the textile art, each being a distinct but necessary corollary of a closely connected series of improvements, by means of which, under appropriate modifications, almost every variety of fabric may be wrought on power looms.

In evaluating his work, one must also keep in mind the nature of the art of weaving. Each fibre employed possesses its own peculiar properties, and whether it be wool, cotton, flax, silk, or wire, the machinery that seizes it must be adapted to those peculiarities. The number of fabrics differing essentially in texture is all but countless. Changes in figures and in color schemes must needs keep pace with the lightning-like

shiftings of a fickle public taste and an ever-varying demand. It would be no easy task to compute all the combinations involved in the production, by automatic machinery, of the numerous dissimilar tissues that bridge the gap between cotton cloth and Wilton carpet, and least of all should we lose sight of the fact that the power-loom, from which proceed these tissues, must possess not only multiplied and complex mechanical movements, but to some extent must have the power of self-adaptation—an ability, in other words, to meet certain exigencies as they arise.

What Erastus Brigham Bigelow actually did was to teach iron machinery, animated by water, steam or electricity, to observe, to think, and to modify its action as changing circumstances may require.

Many people regarded the carpet power-loom to be a mechanical unit, capable of weaving the various kinds of carpets in common use. But such is far from the fact. Bigelow's inventions applied to these classes: First, the two-ply and three-ply ingrain carpets; second, Brussels and Wilton carpets; third, tapestry Brussels and tapestry velvet carpets—each essentially different in their structure, and, although the looms to weave them have some devices in common, their organization and construction are very dissimilar.

A loom adapted to weave tapestry carpets will not produce Brussels carpeting, and a loom adapted to Wilton carpets cannot be made to produce ingrain carpeting.

Among other major inventions made by Mr. Bigelow were revolving tenters for stretching and dyeing gingham; mechanism for imparting and reversing the movement of power looms; mechanism for regulating the tension and delivery of warps; harness operating mechanism and friction brake stop mechanism, whereby the movement of the loom, when thrown out of gear, is suddenly arrested without a shock, and held in position, which invention rendered possible a large increase in the speed of operation of all power-looms, and which was promptly adopted, not only in this country, but in England and on the Continent.

As the first president of the National Association of Wool Manufacturers, Mr. Bigelow was instrumental in securing the adoption of the tariff on wool, in 1867. Two years later, he organized the first great exhibit of the characteristic productions of the woolen industry, which proved to be the precursor of the Philadelphia Centennial of 1876. He was a prolific writer on economic, tariff, and manufacturing subjects and honorary degrees were conferred upon him for his achievements in the field of invention by Yale, Harvard, Williams, Dartmouth and Amherst.

His death occurred suddenly on December 6, 1879, and his mortal remains rest in Woodlawn Cemetery, Clinton, within hailing distance of where his triumphs began in the primitive "Yellow Mill," scarcely an eighth of a mile from his grave. On the north, just beyond the boundaries of this city of the dead where he lies, the looms of the Wickwire-Spencer Steel Corporation chant a daily requiem, while to the east, over the brow of the hill, stand the massive buildings of the worsted department of his beloved carpet enterprise; and a few hundred feet beyond the modern prototypes of his Brussels and Wilton looms hum a benediction to the memory of this great industrial benefactor.

The Clinton he came to as a young man was the home of less than 300 human beings. Today the three enterprises he founded and fostered

—the Lancaster Mills, the Bigelow-Hartford Carpet Company and the Wickwire-Spencer Steel Corporation—locally employ more than 4,000 men and women, and of the 14,000 souls that make up the population of the town fully 10,000 of the total represent the families of those who gain their livelihood in the industrial establishments whose operations were made possible by his inventive genius.

THE LANCASTER MILLS

In 1810, James Pitts, Sr., one of whose ancestors was a maker of clocks, in Taunton, in the eighteenth century; another, the owner of a grist mill in the same town, and a third, the proprietor of an iron foundry in Norton, where cannon was cast for the government in the Revolution, bought of Daniel Aldrich, the water-power privilege, on the Nashua River, which later attracted the attention of Erastus B. and Horatio N. Bigelow.

By trade a millwright, Pitts had constructed machinery for a cotton factory, at West Bridgewater, and, in 1816, built a dam on the Nashua River privilege. Having brought some of the cotton machinery from the Plymouth County town, he employed the water-power in January, 1820, in the manufacture of cotton yarn, later employing fifteen hands. In 1831, he bought a tannery and shop which had been rented to comb makers, and which were located just below the dam, and installed additional cotton machinery.

In 1836 his sons, who succeeded him in business, changed the production from cotton yarn to satinet warps, and operated the factory until 1842 when the water-power privilege and buildings were purchased by the Bigelows for \$10,000, and on January 31, 1844, E. B. Bigelow, Stephen Fairbanks, Henry Timmins, and others, received the act of incorporation of the Lancaster Mills, the entire capital stock of which was not to exceed \$500,000. The plans called for a building 614 feet long by 46 feet wide. The enlarged dam, 322 feet long, was built at that time.

Before the original plant was completed, it was decided to devote production exclusively to gingham, and places were at once made to erect mills having five times the area originally planned. When completed the manufacturing space aggregated 136,013 square feet, in which were housed 20,784 spindles and 550 looms. The capital stock was increased in 1847 to \$1,000,000, and two years later to \$1,300,000.

By 1850, the annual production of gingham reached 4,000,000 yards, and about five hundred fifty hands were employed.

Like all gingham enterprises the Lancaster Mills' management has found it necessary in recent years to adapt its products to new demands created by the ever-changing styles. Of all the cotton textile concerns, no group probably has been faced with more perplexing problems than the gingham producers. Many mills have been forced either to shut down the operation of many looms, or to discover new products that may be turned out on the old gingham equipment.

In this latter direction, the Lancaster Mills have shown much initiative. Some years ago all of its 4,600 looms were engaged in weaving gingham, and the plant is still turning out steadily large quantities of its two most popular brands. But rayon and cotton mixtures, drapery and upholstery fabrics, a wide variety of slip cover stripes, shirtings, and the like have been manufactured lately.

In 1928 about 1850 of the old non-automatic looms were discarded,

leaving 2,750 automatic looms in operation, to which total additions have been made as demand occasioned.

That year 17,000,000 yards of fabrics were sold, and this represented only about half the capacity of the plant.

The same year the management decided to abandon the local production of yarn, as the 101,400 spindles in the plant were not adapted to the manufacture of as fine yarns as are now required in the weaving operations. This made available for other uses the last large unit erected by the corporation—the Amory Mill—a modern four-story brick and steel building, built in 1912, and which was entirely given over to spinning processes.

The corporation also disposed of its tenement house holdings to private owners, in 1928.

The following year it turned some of its looms to the manufacture of tropical worsteds, although centering on the production of its famous Kalbirnie ginghams and novelty cotton textiles.

To the Lancaster Mills falls the honor of having been the first textile plant in the world to install in its plant a large reciprocating engine, with a generator directly connected with it.

Previous to 1897 electric generators supplying current to motors in textile plants either had been driven by water-wheels or had been operated from steam engines by means of belts or ropes.

Up to that time the electric system had not sufficiently demonstrated its advantages to lead mill engineers to consider the union of a reciprocating engine with a generator, but on November 24, 1897, the Lancaster Mills closed a contract with the General Electric Company for a 1250 Kilowatt, 3-phase, 40-cycle, 600-volt generator, directly connected with a cross-compound Cooper-Corliss engine, having a speed of seventy-five revolutions per minute. The installation was made under the supervision of Stephen Greene and when completed drove about one-half of the plant, the balance still being operated by the mechanical system. So successful was the experiment that on May 10, 1899, a second contract was entered into between the mills and the General Electric Company for a 1,650-Kilowatt, 40-cycle generator, together with a Cooper-Corliss engine designed for a speed of 70½ revolutions a minute. With the addition of the second generator the entire plant was driven electrically.

Robert R. West is treasurer of the Lancaster Mills, which has capital of \$4,181,000, and which under normal conditions employs 1,000 hands.

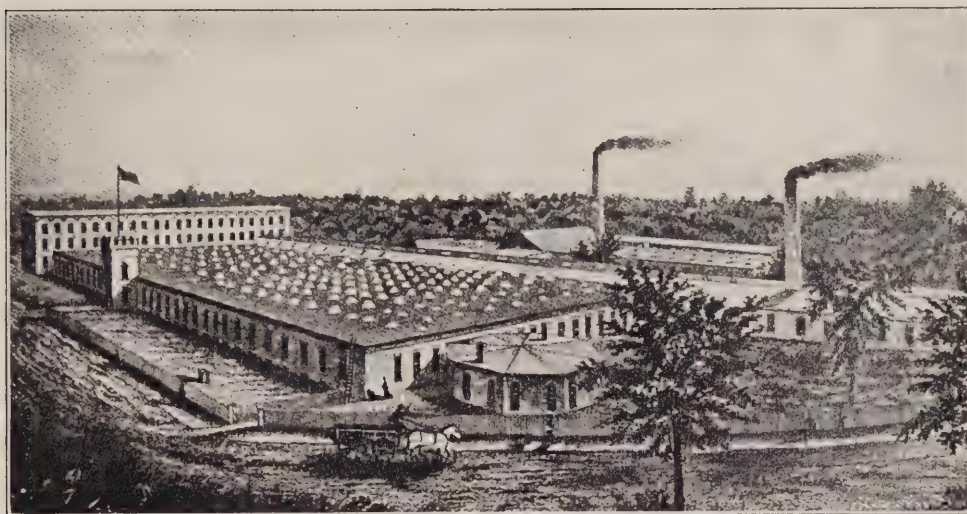
THE BIGELOW-SANFORD CARPET COMPANY, INC.

In the autumn of 1849 the manufacture of Brussels carpets was commenced in Clinton, and two years later twenty-eight looms were producing a daily average of 500 yards.

In 1825 there was started at Medway, in this state, a small ingrain carpet mill, owned by Henry S. Burdett, and supervised and managed by Alexander Wright, who worked entirely with hand looms brought from Scotland.

In 1828 the Lowell Manufacturing Company bought the Medway Mills, and eventually moved the machinery from Medway to Lowell, and Alexander Wright became the first agent of the Lowell Company.

Today the small carpet mill originally at Medway, together with the mill founded by Erastus B. Bigelow at Clinton, the E. S. Higgins Carpet



LANCASTER MILLS, CLINTON, IN THE '60s



LANCASTER MILLS, CLINTON, 1928

Company and the Hartford Carpet Company, under the old name of the Bigelow-Hartford Company, has grown to a company with two groups of mills at Clinton, in this state, and at Thompsonville, Conn., which have a combined floor space of 2,830,000 square feet, and employ upwards of 5,500 men and women, engaged in the production of high-grade floor coverings that find their way into theaters, hotels and homes in every section of the country, in ocean liners, Pullman cars and even in the cabins of modern aeroplanes.

In 1854, the Bigelow Carpet Company was incorporated by Erastus B. and Horatio N. Bigelow, and Stephen Fairbanks, with capital of \$500,000, which in 1875 was increased to \$1,000,000.

Enlargements to the plant followed from year to year until today the corporate successor of the original corporation—The Bigelow-Sanford Carpet Company, Inc.—employs 1,200 operatives in the Clinton unit.

This concern is another Massachusetts enterprise where progressive methods and management have conspired to give it added prestige in the carpet and rug fields.

Whether you traverse the lobbies, or the suites of the Bowman, Statler, Knott, United, Manger, or the thirty odd other chains of American hotels, you tread on Bigelow-Hartford carpets and rugs. Eighty hostleries in New York city, seventy in Chicago, thirty-three in Detroit, thirty in Boston, and from one to upwards of one hundred, in each of the forty-eight states of the Union, are equipped with the company's products, and whenever you wend your way down the aisles of a Pullman car you walk on a Bigelow-Hartford carpet.

In 1900 the company brought out the famous "Hartford-Saxony" line of high-pile Wilton rugs and carpets, still a leader in its field, and six years later it introduced the Servian Rug, an American-made oriental, with pattern showing through on the back as in oriental hand-made rugs. A recent further development along this line is the production of a high-grade, so-called "Domestic Oriental," with lustrous sheen and soft texture equal to that of the more expensive hand-made rugs, with a complete line of authentic designs which is marketed under the name of "Arada."

The company was also among the first to feature floor covering designs, and its present line includes many motifs of this character in many different patterns. Another line which has found popularity is comprised of machine-made hooked rug designs, many of them being copies of old Colonial pieces.

Wools used in the manufacture of the company's rugs are brought from all parts of the world, many of them coming from the United Kingdom, Asia Minor, China, and South America.

In former years people bought carpets or large rugs in narrow strips and sewed together in sizes to fit the room; but today the big demand is for the broad-loom or seamless product, and here the Bigelow-Sanford organization has set the pace, and its output today is largely of that style, with rose or blue fields. If figures are wanted the preference is for the Oriental or Persian patterns, which have many virtues to commend them, where the rugs are subjected to much wear or exposure to light.

While the Bigelow concern makes heavy tufted rugs for hotels and theaters which usually require special designs, and set their own styles, its industrial program for 1929 reflected a demand for style changes from

the public almost as pronounced as the styling of women's wear. The rugs and carpets made that year represented the latest trends in interior decoration and were styled with their place in the ensemble carefully in mind. Fabric, colors and patterns were designed to meet certain well-defined customer requirements, as learned from study of the public's demands, and following interviews with retailers all over the country. Of the existence of a style trend in the rug and carpet industry the customer becomes quickly aware when examining the vast displays in the big stores, luxurious in design and color, and the Bigelow-Sanford Carpet Company has brought to light the additional information that there is a new vogue in the application of floor covering. The tendency is toward the complete covering of the floors of chambers, instead of merely placing rugs and leaving parts of the floor bare.

The company's program of nation-wide coöperation with the trade is not only carried on by means of personal calls on the dealers for the purpose of discussing matters at close range, but also by expansion of its cut carpet service by the addition of new grades, and by the publication of a stock and process book every two weeks and of the "Bigelow-Sanford News" every month in which magazine it presents to the public the latest available information regarding floor covering, styles and selling methods. Another merchandising service which this company offers to stimulate the industry is to assist dealers in planning or rearranging retail floor covering departments.

There certainly are no signs now that Massachusetts is slipping so far as the rug and carpet industry is concerned.

Under the presidency of John A. Sweetser, the former Bigelow-Hartford Carpet Company made marked strides within recent years.

It has grown to be one of the largest concerns in its field, with sales during the past half-dozen years averaging better than \$20,000,000 annually, and reaching a total in 1928 of \$22,030,000. In the past seven years the company has expended more than \$8,600,000 to keep its plants up-to-date.

The company's current assets on December 31, 1928, were \$13,306,703, current liabilities \$1,244,147, net quick assets, \$12,062,556, a ratio of 10.7 to one, and its earnings that year were 9.35 per share on its common stock. It has capital of \$17,575,000, and employs 1,600 operatives.

The equipment at the Clinton plant includes 357 narrow looms, and forty-nine wide looms, and the capacity is 3,000,000 yards of carpeting annually. It uses 4,500,000 pounds of wool in the grease, each year, and the annual value of the products manufactured at Clinton approximates \$12,500,000.

As of November 30, 1929, the stockholders of the Bigelow-Hartford Carpet Company ratified the plan proposed by the directors earlier in that month for the purchase of the plants and inventory of Stephen Sanford & Sons, Inc., of Amsterdam, N. Y., and the combining of the two corporations under the name of Bigelow-Sanford Carpet Company, Inc. John A. Sweetser continues as president of the new concern; Harry V. Campbell, as vice president in charge of sales; Frank H. Deknatel as treasurer; James J. Delaney, as secretary; John Sanford, as chairman of the board and Richard G. Knowland, as vice president in charge of manufacturing.

THE WICKWIRE-SPENCER STEEL CORPORATION

The invention by Erastus B. Bigelow of a power loom for weaving wire cloth led to the establishment of the Clinton Wire Cloth Company in 1856, under which corporate designation the concern operated for fifty years, during which period it grew to be the third largest industry in Mr. Bigelow's adopted town.

When the merger of many Massachusetts units was brought about with the Wickwire Steel Company of Buffalo, N. Y., less than ten years ago, various wire concerns in Clinton, Worcester, Palmer and Spencer were consolidated in the Wickwire-Spencer Steel Corporation, and the Clinton Wire Cloth Company was absorbed.

With the closing of one of the Worcester divisions of the new corporation a few years ago, the equipment of that plant was removed to the Clinton plant, and some seventy-five or more former employees were added to the local force of approximately 1,000 men.

In 1929 the corporation expended about \$50,000 in reequipping the galvanizing department of the Clinton plant with new machinery.

The local plant is most modern, many new buildings having been erected and additional realty acquired during the present century.

CLINTON'S DIVERSIFIED INDUSTRIES

Although Clinton, as a corporate entity, did not come into existence until 1850, the manufacturing operations of the community began as early as 1654, when the first grist mill, erected on the site of the present Water Street mill, was built by John Prescott only to be destroyed a few years later by the Indians.

Rice's sawmill was the second local manufactory, being erected where the present woolen mill of the Bigelow-Hartford Carpet Company stands.

On August 18, 1809, David Poignand, a refined and elegant French gentleman, sporting a gold-headed cane, arrived in the village, and with Samuel Plant tore down the decaying remnant of the old Prescott grist mill, and erected a brick factory—the first in America where raw cotton was turned into cloth under the factory system, and antedating by a few years the Waltham plant.

The story of this enterprise is told at length in the chapter of this work devoted to the coming of the first cotton mills in Massachusetts.

It was under the genius of Sidney Harris that the local comb industry developed locally to large proportions in the days that have long since passed.

In 1847, Gilman M. Palmer organized the Clinton Foundry Company which he conducted until 1881, when the business was purchased by Christopher C. Stone. In 1897 his sons, George C. and Walter A. Stone, and Gordon A. Brown, his son-in-law, entered the firm as partners, and ten years later the concern was incorporated under the same name it had carried for fifty years. It manufactures iron, brass and aluminum castings for machinery and structural work and employs fifty operatives. Walter A. Stone is president; George C. Stone, treasurer, and Gordon A. Brown, secretary.

In 1853 the Loom Harness & Reed shop was started by George H. Foster, and twelve years later was taken over by the late William H. Gibbs, who continued its operation under the corporate name of the Gibbs Loom

Harness & Reed Company. It is today owned and managed by his sons, Earle R. and Lester H. Gibbs, the latter being president and the former, treasurer and secretary. The corporation has capital of \$50,000 and it employs thirty-five operatives.

In 1865, Ephraim Fuller's Mills, later owned by Andrew L. Fuller, covered 75,000 yards of steel wire daily, while eighteen tape looms wove 15,000 yards of wire each day—all this to meet the then existing demand for hoop skirts. How times do change!

A flourishing tannery and a soap factory were destroyed in 1876 when the Mossy Pond dam gave way. The Parker Machine Company, the Bellevue Mills, the Witherell Shoe Company, the Clinton Wall Trunk Company, and other local concerns rose and fell, the plant of the latter corporation serving as the nucleus of Clinton's present fourth largest industry—the Roubaix Mills, Inc.

Even as Paul Moody was the mechanical genius of industrial Waltham and Lowell, so Joseph B. Parker, a native of Princeton, may be described as the translator into mechanism of Erastus Brigham Bigelow's revolutionary textile process. Learning the trade of a blacksmith and spending nine years in Samuel I. Flagg's machine shop, at Oakdale, his coöperation was sought by Mr. Bigelow in building the original coachlace and counterpane looms, and while operating a machine shop of his own, in Providence, R. I., he was induced to remove to Clinton, to assume charge of the new machine shop of the Clinton Company. Here he built the improved counterpane and the gingham and Brussels carpeting looms for the new mills. Nine years later, with Levi Greene, he purchased the planing mill machinery business operated by Messrs. Belyea and Howe and built a shop, but in March, 1851, he sold his interests and went to England to set up Brussels carpet looms for Mr. Bigelow. Returning to Clinton, he entered into partnership with Gilman M. Palmer, and, in 1852, erected a machine shop. The concern was incorporated in 1875 as the J. B. Parker Machine Company and from fifty to one hundred men were employed.

From almost the beginnings of the town the Fuller family has been identified with the lumber industry, W. A. Fuller & Son, Inc., being the outgrowth of the business established by Eben S. Fuller in 1859, and incorporated in 1924. The company, capitalized at \$100,000 employs fifty operatives in producing cabinet work. John F. Fuller, grandson of the founder, is president and Everett A. Greene is treasurer. Prior to the new corporation the concern was known as the E. S. Fuller Company, the William A. Fuller Company and the William A. Fuller & Sons Company.

The W. J. Coulter Press, Inc., takes rank as one of the oldest printing establishments in Worcester County, and in addition to publishing two newspapers carries on an extensive printing business, including book work.

Like all similar businesses the concern has advanced from hand lever power through steam and water to electric power; from hand folding of papers to modern presses with papers going in on large rolls and coming out printed and folded, ready for distribution; from hand cutting to electric power cutting machines, and from hand setting of type to three linotypes and a Ludlow. In fact, the concern is fully equipped in editorial, news, job and press rooms as completely as any modern plant.

The business was incorporated as The W. J. Coulter Press in December, 1914.

Clarence C. Coulter is president and treasurer, and Miss Annie M. Coulter, secretary, of the corporation.

In 1905, Harold A. Shuman established the Earnsdale Worsted Company and material plant additions have been built in the intervening years. High quality fancy worsted goods for suitings are manufactured, and upwards of one hundred operatives are employed.

The corporation was incorporated in 1928, and Harold A. Shuman is president and treasurer.

THE ROUBAIX MILLS, INC.

The Roubaix Mills constitute positive proof that there are in these days American manufacturers who are as astute and long-visioned as any who created industrial enterprises during the last century.

Due to the difficulties encountered in obtaining fine foreign women's woolen and dress goods in 1915 and realizing that this market would be short of such fabrics for many years to come due to war conditions and the chaotic situation to be expected following its close, Messrs. Benjamin F. and Albert Haas, of New York City, sensed the possibilities and opportunities that would likely flow from a fine goods mill set up in America.

As in many other industries, the artificial tariff barrier created by the World War afforded an exceptional chance to take such a step, and in the last analysis this factor was primarily responsible for putting the plan into action.

From the outset the sole aim of the founders of the mill has been and is today to produce the finest merchandise that can be marketed in the United States, and the inflation period during and after the war naturally increased the purchasing power of the domestic consumers, and materially helped in the promotion of the scheme.

Casting about for a suitable location, the attention of the Haas Brothers Fabrics Corporation was directed to the idle plant of the defunct Clinton Wall Trunk Manufacturing Company and in December, 1919, the Roubaix Mills were incorporated, with the modest capital of \$50,000 and a lease was taken of the ground floor of the old wooden plant, with an option to purchase. The original equipment consisted of twenty-two looms, and two dye pots, but ere two years had elapsed the entire property was purchased, arrangements made for increased equipment, and in 1917 a one-story concrete and brick structure was erected to the north of the old weave shed, in which additional finishing machines were installed.

In June, 1918, twenty-four more looms were installed, and two stories were added to the concrete finishing department. The following January this structure was enlarged to double its capacity. When a total of 144 looms was reached the management found that a modern loom shed and yarn stock room were necessary if the increased product flowing from a greatly amplified loomage was to be cared for, and these structures were erected.

In the intervening years further additions have been made and practically all equipment and all departments are now housed in brick and concrete structures of the most modern type. In 1919 the original capital was increased five times to \$250,000, and in 1922 to \$650,000, and again in 1926 to \$710,000. The latter year saw the addition of thirty-six more looms, bringing the total to 180.

The management studied the market with the greatest care, while fashion trend, an important and too frequently neglected factor of the textile trade, was made the sole work of a separate department. Equipment was given the closest scrutiny, efficiency methods, and modern cost-finding systems were installed, and in fact, all up-to-date industrial methods, art and fashion markets, the psychology of the buyer, consumer and of labor—all were placed under the microscope, and analyzed and studied.

Today, when keen competition in textile fields of the entire world exists to such a marked degree these efforts are intensified and the aim and ambition of the promoters are not abandoned but upheld with more vigor than ever.

The high ideal set for the Clinton plant will drive it on for success in the future.

B. F. Haas is president, Albert Haas and J. R. Lister, vice presidents, and A. R. Haas, treasurer, and the concern employs 250 to 300 operatives, and is Clinton's fourth largest industry.

THE E. R. BUCK CHAIR COMPANY, INC.

In September, 1923, the E. R. Buck Chair Company, Inc., was formed to succeed the E. R. Buck Chair Finishing Company, of Sterling. Previous to that date the concern bought its products from manufacturers of chairs in West Sterling, Baldwinsville, and Gardner, but the officials decided to engage in the production of the commodities. The successful outcome of this policy necessitated the erection of a new finishing plant, separate from the production unit, but before the structure could be finished a disastrous fire on June 2, 1927, destroyed the entire plant. On July 1, of that year, it was decided to purchase the idle brick plant, of the Sterling Textile Company of Clinton, three stories high, with a one-story annex, containing 25,000 square feet of floor space. Modern chair-making machinery was installed, dry kilns added, and on August 26, the first shipment of chairs made in the new factory, was made—less than three months from the day of the fire. Many of the employees who had worked in the Sterling plant are carried on the present payroll, and Phenix-like the concern has risen from the ashes, and is now numbered among Worcester County's progressive manufacturing enterprises.

The corporation has capital of \$35,000 and employs thirty operatives. James M. Buck is president and treasurer, and R. S. Antonio, secretary.

OTHER MANUFACTURES OF CLINTON

On July 1, 1927, the Armion Textile Corporation, a subsidiary of the Roubaix Mills, Inc., which had been operated in New York state for about a year and a half previously, was removed to Clinton, where the equipment consisting of 3,200 spindles, was installed on the third floor of the main brick mill, of the Roubaix unit, and at the outset employed forty operatives on twenty-four-hour working schedules, in spinning silk yarn of the highest grade. The reason for the removal was that power, rent, and other costs were cheaper in Massachusetts, than in New York, coupled with the fact that operations could be supervised more closely at Clinton, where the benefits of the mechanical department of the Roubaix Mills were available. The throwing plant only is conducted there, the weaving operations being carried on in Pennsylvania. The company has capital of \$200,000, and employs fifty operatives. B. F. Haas is pres-

ident; B. C. Speckman, secretary, and Albert Haas, vice president and treasurer.

P. J. McMorrow, Inc., occupies one floor of the west wing of the Water Street mill, where carpetings are cut to order for hotels and public and private buildings, much of the material being produced at the local plant of the Bigelow-Sanford Carpet Company, Inc.

The Clinton Towel Company, owned by Joseph and Ernest Tattersall, operates a plant in the Swift & Co. building, where Turkish towels and wash cloths are produced.

In 1927 Clinton was cited as a conspicuous example of an industrial town maintaining to the advantage of its taxpayers a Finance Committee to prepare and present to the voters a budget of municipal expenditures, which over a period of fourteen years has been studiously adhered to in voting town appropriations.

The personnel of its Finance Committee consists of representative business men, in whom the citizens have the utmost confidence and their recommendations are considered final. Such a course accounts for the enviable record this particular municipality has earned. Of all the sizable industrial municipalities in the state it reported, in 1927, a local tax rate of \$21.50 per \$1,000—the lowest figure returned that year by any manufacturing town in the commonwealth.

THE MANUFACTURES OF DANA

Warren Hale and Allen Goodman, of Dana, were granted a patent in 1845 covering a lathe for turning piano legs, and other irregular articles, and three years later, Mr. Goodman, as the assignee of William Gibbs, of Prescott, was given a patent on a lathe for turning irregular forms, and another for self-acting machinery for turning such shapes to any desired pattern from blocks of lumber.

In 1929 the Swift River Box Company, the Crawford & Tyler Company, manufacturers of cassimeres and satinets, and employing thirty-five operatives, and the Swift River Hat Company, all located at North Dana, and adjacent to the Swift River, were forced to yield to the inexorable march of progress and to seek new locations, or retire from the manufacturing field, due to the taking over of the territory where their physical properties were located by the Commonwealth of Massachusetts for the water project of the Metropolitan Water Commission.

The Swift River Hat Company is a unit of a New York corporation.

The Crawford & Tyler Company, owned by William J. Crawford, ninety-two years old, and one of the oldest active industrialists of Massachusetts, bids fair to continue operations, as its proprietor announced his unwillingness to withdraw from the field of manufacture.

The Swift River Box Company, owned by F. S. Grover and Charles E. Gee, employ thirty-five operatives in the manufacture of boxes and shooks.

George B. Burnett & Son, whose main plant is in Amherst, operates a branch unit in North Dana.

THE INDUSTRIES OF DOUGLAS

Prior to 1790 a refining forge was set up in Douglas, being supplied with bog ore, from Uxbridge.

For a hundred years, Douglas was known as the great axe town of the United States.

Production of axes began there in 1790 by Joseph and Oliver Hunt, and when, in 1834, the American Axe & Tool Company was formed, it was the successor of the rude forge established by the Messrs. Hunt.

In 1836 the Douglas Axe Manufacturing Company was incorporated, with original capital of \$80,000, which later rose to \$400,000, to succeed the American Axe & Tool Company. The year after incorporation the output amounted to 121,400 axes, valued at \$116,400, and the concern ultimately grew to occupy five buildings and it operated thirty-four trip hammers, and sixty-five forges, while 300 hands were employed to whom were paid \$200,000 a year in wages.

The company's products received the highest awards at three international expositions—London, Paris, and Vienna.

In 1808 a cotton factory was established in the town, and two years later a satinet mill was started.

In November, 1811, Richard Olney purchased land on the bank of Mumford River, in East Douglas, organized the firm of Richard Olney & Co., and built a cotton spinning mill, which later became the Douglas Cotton Manufacturing Company. In 1817 Mr. Olney erected another mill in Douglas, and the following year one in Oxford, where he engaged in woolen production.

C. Whipple, J. Sprague, and M. D. Whipple, of Douglas, received a patent on April 3, 1835, on a lathe for turning irregular forms, the grant being assigned to Carter & Hender, of Boston, principal owners of Thomas Blanchard's earlier patent.

THE HAYWARD AND SCHUSTER ENTERPRISES

The present day Hayward Worsted Company was founded by Warren Hunt, and began operations in a plant, built in 1863. It has reached its greatest development during the regime of the Haywards and the Schusters of the present generation. This corporation, and the Schuster Woolen Company, which was formed in 1904, employ approximately 500 hands, each of the concerns being capitalized for \$600,000, and constitute the outstanding industrial plants of the town.

The Hayward unit was not incorporated until 1916. It is equipped with fifteen sets of cards, fifty-six broad and 160 narrow looms, 4,872 woolen spindles, and complete dyeing and finishing departments, three boilers, and two water wheels, and manufactures cloakings, cassimeres, and suitings. William L. Hayward is president, Hon. Walter E. Schuster, treasurer, and Wendell Williams, clerk; it employs 275 operatives.

The plant of the Schuster Woolen Company manufacturing woolen suitings and overcoatings, is equipped with fourteen sets of cards, 204 narrow looms, eight pickers, 4,368 woolen spindles, a finishing department, three boilers, and two water wheels, and employs 275 operatives.

Harry T. Hayward is president, Wendell Williams, secretary, and Hon. Walter E. Schuster, treasurer.

Soon after graduating from the Uxbridge High School, the late William E. Hayward entered the Blackstone National Bank, in that town, as a clerk, and after eight years of service, bought a small interest in the Capron Woolen Mills, and for the thirteen succeeding years was a member of the firm of Capron & Hayward, and for twelve years thereafter

the senior member of the firm of Hayward, Taft & Co., which operated a mill in Proctorsville, Vt. During this period he also conducted another plant, with Moses Taft, in East Douglas, and in 1890 purchased his partner's interest in that enterprise. With the late Hon. Winfield S. Schuster, he formed the firm of W. E. Hayward & Co., and four years later built the modern plant, of which the citizens of East Douglas are so proud.

Upon the deaths of William E. Hayward and Hon. Winfield S. Schuster, the management of the Hayward and Schuster Mills devolved on the former's son, William L. Hayward and the latter's brother, Hon. Walter E. Schuster.

THE RISE OF THE STEVENS LINEN COMPANY

The town of Dudley boasts one of the oldest textile enterprises, established in this Commonwealth, and perhaps the very oldest in point of continuous operation.

The Stevens Linen Works rose out of the famous embargo of 1809, and the subsequent events which ultimately led to the second war with England.

Originally formed and known as the Dudley Mill Company in 1812, operations were carried on under various managements until 1846, when the concern was incorporated as the Stevens Linen Works, and H. H. Stevens became its owner.

It now has capital of \$1,050,000, is equipped with 750 looms, 8,300 spindles, and a modern bleachery, and employs upwards of 500 operatives.

It is practically the only plant in America in direct competition with the linen industries of Ireland, and the only unit of large size now operating in Massachusetts engaged in the production of linen crash.

In 1928 a large addition, consisting of a two-story mill, with basement, costing upwards of \$100,000, was erected, the plans being drawn by Charles T. Main, of Boston. More than 100 additional looms were installed and a rearrangement of the mechanical equipment followed the completion of the new unit, thus improving the regular sequence of production in the various departments, and affording less handling in the process of manufacture.

Nathaniel Stevens is president, and William T. Dowling, treasurer, of the corporation, which maintains its Boston office at 78 Chauncy Street.

For a period of ninety-one years the Perryville Woolen Mills, Inc., of Dudley, were continuously operated by members of the same family, having been established by Josiah Perry, of Dudley, who began the manufacture of a double-twist fabric in imitation of worsted, and who, at the same period, was one of the first to use silk and wool in striped goods. The concern is capitalized at \$200,000 and employs upwards of 225 hands.

John G. Zabriskie is president, and John B. Thompson, secretary and treasurer, of the corporation. Fancy cashmeres and cheviots are the present-day products.

In 1824 the Tufts Manufacturing Company was incorporated, in Dudley.

THE INTERVALE MILLS, INC.

In 1870 the late Hon. Eben S. Stevens built a dam on the Quinebaug River, in Dudley, and the following year erected a small mill in which

jute bagging and rope were manufactured, this line being continued until 1889, when the production of jute products was superseded by satinetts, and later by medium and low-priced suitings and medium-priced overcoatings. This unit has long been known as the Quinebaug Mill, and is one of the two plants, operated by the Intervale Mills, Inc., the other being the Puritan Mill, in Webster. The business was incorporated in 1920, and upon the death of Mr. Stevens, in 1924, Eben C. Cleveland was chosen president with Edwin C. Cleveland, vice president; Clarence E. Cleveland, treasurer, and Clifford M. Jordan, clerk. Capitalized for \$450,000, the plants employ 250 operatives.

THE WEST DUDLEY PAPER COMPANY

In 1911, the Burmus Paper Company began manufacturing, at West Dudley, selling its assets five years later to the West Dudley Paper Company, which entirely rebuilt the mill, in 1919 and 1920.

At the present, the concern operates a five-cylinder board machine, trimming 90 inches and produces from seven to eight thousand tons of paper per year, fifty hands being employed.

Lowell Pierce Emerson is president, and Lowell Emerson, is treasurer and secretary of the concern, which has capital of \$250,000.

THE INDUSTRIES OF EAST BROOKFIELD

Worcester County's youngest town—East Brookfield—less than ten years old, has two textile plants. The Mann & Stevens Woolen Company was incorporated in 1897, with capital of \$25,000 and is engaged in the manufacture of three-quarters cotton warp overcoatings, cloakings, and suitings, the plant being equipped with five sets of cards, sixty-eight looms, 560 woolen spindles, and dyeing and finishing departments.

John P. Stevens is president and treasurer, and Billings M. Stevens, manager, and eighty operatives are employed.

In 1838, Amos S. Earle and Billings Mann began business as Earle & Mann, in what is known as Mannville, in the northeast part of Leicester. They continued until 1844 when Nathan Daniels became Mr. Earle's partner in the firm of Earle & Daniels. In 1853, Mann & Marshall purchased the property and continued in business for twenty-two years. In 1875, Billings Mann & Company acquired the plant, and four years later George Mann & Brother took over the business. In 1897, it was incorporated as the Mann & Stevens Woolen Company and was then moved to East Brookfield, since the action of the City of Worcester in acquiring the water privileges at Mannville deprived the firm of necessary power for manufacturing. Operations have been continuous in East Brookfield up to the present. The plant is connected with the Central Massachusetts Electric Company by a 240-horse-power generator, has a steam plant of its own with a 150-horse-power engine, and a water-wheel capable of delivering seventy-five horse-power. The plant is located on what is known as the Seven Mile River, with water rights extending back to the source at Browning's Pond in North Spencer and Paxton.

The Daniels Manufacturing Company which was established in 1916, by George and John Daniels, to engage in the manufacture of men's and women's wear woolens and cassimeres, operates eleven sets of cards, ninety-two broad looms, 5,260 woolen spindles, and dyeing and finishing

departments. It employs 250 hands, and its growth in the last ten years has been marked.

GRAFTON'S MANUFACTURES

The industries of Grafton are mainly textiles, and include the Fisher Manufacturing Company, established in 1881, and located in the Village of Fisherville. The concern has capital of \$750,000 and employs 700 operatives in the production of fancy cotton goods. The plant is equipped with 1,100 looms, 29,000 ring and 8,064 twist spindles, four boilers, and the same number of water-wheels.

Arthur Lyman is president; F. P. Cabot, treasurer, and L. R. Kerr, agent.

In October, 1908 the Wuskanut Mills, Inc., were established, and acquired the Excelsior Mills, in Farnumsville. New machinery was installed and the mills were incorporated, in 1920, with capital of \$1,000,000. They have acquired a splendid reputation in the field of men's wear worsteds, and the plant is equipped with 270 narrow looms, 4,400 worsted and 2,240 twist spindles, complete dyeing and finishing departments, two boilers, and two water-wheels and employs 500 operatives.

Jacob F. Brown is president; Albert S. Howe, vice president; H. B. Whitman, treasurer and secretary, and Harry H. Daw, agent.

In 1917, the Lund Textile Company was incorporated, with \$100,000 capital to manufacture draperies and cotton and silk corset fabrics, and the plant, at Farnumsville, is equipped with 200 broad looms. Paul L. Brandt is president; J. W. Weinberg, treasurer and John T. Lund, secretary. Three hundred hands are employed, and the corporation has a Boston office at 52 Chauncy Street.

The Grafton Woolen Mills, equipped with five sets of cards, produce wool substitutes, and carry on custom carbonizing, carding and picking.

Herbert Taylor is president; A. W. Coolidge, secretary, and H. G. Mitchell, treasurer.

The Linen Thread Company of Massachusetts operates a plant, at North Grafton, where linen and flax thread, yarns and twines, are produced, and where dyeing as well as manufacturing operations, are carried on. David Harvey is manager, and James Murphy, superintendent of the concern.

The Washington Mills Emery Manufacturing Company at its North Grafton plant employs twenty operatives in the production of Turkish emery. The concern is capitalized for \$40,000.

Oliver Ames is president, and C. H. Crocker, secretary and treasurer, of the corporation.

The Forbush Shoe Company has its plant, at North Grafton, the corporation having capital of \$250,000. It employs 300 operatives in the production of shoes. Francis M. McGarry is president and treasurer, and F. A. Andrews, secretary.

A NEW CONCERN FOR GRAFTON

Three idle factory buildings, once the plant of the Saunders Cotton Mills, a farmhouse, a large braiding house, several residences, the town water supply rights on the Blackstone River, and fifty acres of land, bordering the tracks of the N. Y. N. H. & H. R. R. Co., all located in the village of Saundersville, in the Town of Grafton, were purchased in No-

vember, 1929, by the Vanadium Wire Company, Inc., a new corporation, capitalized for \$250,000, of which Alfred J. Jacobson is president; Eric Jacobson, vice president and works manager, and William W. Woodward, treasurer, all of Millbury.

Work began on Monday, December 2, 1929, on the installation of wire-making machinery and in converting the power plant from coal to fuel oil. It is hoped to have the works in full operation by April, 1930, and provision will be made for the employment of 250 operatives at the outset.

The new company has orders on hand to insure steady operations for well over a year. The specialty will be wire strings for musical instruments and wire for automobiles and automobile accessories of various types.

Because of the special machinery and the high calibre of workmanship required for the production of these types of wire, most of these commodities are now being imported either from Sweden or Germany.

President Jacobson holds patents on nearly one hundred inventions of machinery and devices for the manufacture of high carbon steel wire. He was one of the founders of the New England High Carbon Wire Company, of Millbury, a producing concern which has employed Mr. Jacobson's machinery and patents.

THE INDUSTRIES OF HARDWICK AND HARVARD

Previous to 1773 a furnace was erected on the Ware River, at Furnace Village, in Hardwick, by Joseph Washburne, of Braintree, who, on a petition filed with the General Court, received a grant of a limestone plant, near Ashfield, for the use of his enterprise.

In the village of Wheelwright is located one of the plants of the George W. Wheelwright Paper Company manufacturers of book paper, whose history is treated in the chapter devoted to the industries of the City of Leominster.

Here, too, is one of the units of the George H. Gilbert Manufacturing Company, the story of which is carried in the history of the manufactures of the town of Ware, where the main plant is located.

In 1873, a company of twenty-five persons was formed in the Town of Harvard, under the direction of Messrs. Ives & Peck to mine silver ore. A search was continued, through superimposed earth and for fifty feet into solid rock, but was abandoned in 1789 after an expenditure of about \$1,100 had been made, the "mineral rods" apparently proving fallacious in this instance.

Previous to 1793 a bloomery forge was erected in Harvard.

THE MANUFACTURES OF HOLDEN

In 1809, in the village of Unionville, in Holden, Eleazer Rider & Son began to spin cotton yarn and in 1822 power looms were installed in the plant, and the manufacture of cotton cloth was begun.

In the village of Eaglesville, Samuel Clark carried on spinning and weaving, by power, in 1831, and nine years later he had 1,600 spindles and forty looms.

In what is now known as the village of Jefferson, a satinet mill was built, in 1825, and at the same period Colonel Artemas Dryden was operating even a larger plant there. At an earlier period he was engaged in wool-carding. About 1825 B. T. Southgate built a mill at North Woods

Village, for the manufacture of woolens, changing the production to cotton, two years later.

In 1831, S. Damon established a cotton mill in Quinapoxet Village, and cotton-batting and candle-wicking were produced by John Lovell, the plant later being owned by the Lovell Woolen Company and Cyrus G. Woods, of Uxbridge. The latter built the Moss Brook Mill, for making shingles, and in 1869 sold it to Charles Dawson who manufactured satinets there. These fabrics were also made in the village of Chaffin's, 115 years ago. In 1875-76, J. L. Smith, of West Boylston, built the Springdale Cotton Mill.

Some of these old plants have been modernized and are operated today, especially those built on water-power privileges.

The Jefferson Manufacturing Company was established in 1864, in the village of Jefferson, and is owned by W. H. and R. H. Coe, who employ 275 operatives in the manufacture of overcoatings and cloakings. It was incorporated in 1906 and is capitalized for \$50,000. The plant is equipped with fourteen sets of cards, 100 broad looms, 5,040 woolen spindles, four pickers, complete dyeing and finishing departments, and three boilers. W. H. Coe is president and R. H. Coe, treasurer.

The Quinapoxet Manufacturing Company, of which Edmund Schwartz is president and treasurer, manufactures suitings, cloakings and thibets, in a modern plant, in the village of Quinapoxet, to which many additions have been made within the past five years. The equipment includes eight sets of cards, 102 narrow looms, 2,592 woolen spindles, four pickers, complete dyeing and finishing departments, two boilers, and a water-wheel, and 150 operatives are employed.

THE STELLAR INVENTIONS OF THE DRAPER FAMILY

Modern civilization has made two demands upon industry, and in no field perhaps have these been so marked and so constant as in the textile division, due to the fact that even from the dark ages it has ministered to one of the primal needs of man. Next to the food required to keep body and soul together came raiment with which to clothe humankind and as civilization advanced, and as nations grew in population larger quantities of material for old demands were necessary with a concomitant increase in diversity of the new requirements.

Two avenues only were open to those who catered to these demands—one to create more and more producing units; the other to enhance the efficiency of these units.

The spinning wheel of Colonial days was superseded by the primitive spindle, and then by the modern high-speed device; the hand-loom gave way to the power loom, and the latter in turn to the automatic loom.

The product per operative has increased a number of thousand times, and the sum total of invention and evolution in the textile art has enabled the value of a single operation in the industry to become the productive equal of several thousand operations of three hundred years ago.

This capacity of one operative to do the work previously performed by several thousand leaves the latter group free to turn to other avenues of service in meeting the requirements of modern society. The increasing effort of the textile producer has been to increase the products per operative, without sacrificing the quality of the fabric. Even to the expert much of the cloth woven today could scarcely be distinguished from that turned out two or more centuries ago, but the industry of that era, with

its now obsolete and discarded methods, would have required the labor of the entire population of that time to equal the product of one of the large textile mills of today.

In terms of invested capital, number of operatives, and volume and value of product, the most important division of the textile art is cotton manufacturing. Consequently any industrial corporation that concentrates upon improvements designed to advance that art can hold no other position in the world today than that of a benefactor to mankind.

It matters little what material profits such a concern may have enjoyed during the period of its existence.

The question is whether it has contributed to efficiency and to increased productivity, and if the answer is in the affirmative, then it takes its position as a force for world advancement.

For upwards of a hundred years the Draper Corporation, of Hopedale, and its predecessors have been correlating the inventions of scores of geniuses designed to improve hitherto existing devices and machines.

The patent law of the United States, with its seventeen years monopoly, constitutes a very inadequate protection to a finished art, nor is it a great asset where the recipient of a patent is either unable or unwilling to continue the monopoly in his chosen field by constant efforts designed to improve the original device.

It has been the effort of those who have directed the destiny of this concern to keep seventeen years ahead of the open art by a constant effort to improve its products, to cheapen the cost of manufacture of the machinery it fabricates, and to simplify the component parts.

It is as interested today in inventions in its peculiar line as it has been in the past, and many of the most important improvements made in its machines have been invented outside the walls of its Hopedale plant.

During its more than a century of existence the Draper organization has permitted manufacturers to use and to adopt a large variety of textile improvements, originally discovered in the Hopedale works, but these have never cost a single mill a solitary penny by way of royalty to others, or in the defense of patent actions. A device bought from the Draper Corporation has brought with it complete protection from the expenditure of time and money on patent litigation. Coupled with this immunity from patent annoyances the company conservatively claims that it has cut in halves the cost of spinning, spooling and weaving.

IRA DRAPER'S GREAT CONTRIBUTION

To Ira Draper, the inventor of the self-acting temple for looms, the Draper Corporation, one of the oldest and largest textile machinery producing companies in the world, and with an international reputation, primarily owes its existence. His contributions to the perfection of the twentieth century loom are fully as important as were those of John Thorp to the foundation of mass production in spinning, as the former's inventions have served as the basis for all subsequent loom developments. On January 7, 1816, Ira Draper patented the rotary temple, the invention being contemporaneous with the pioneering days of the cotton industry in the United States. It is a singular coincidence that while Francis Cabot Lowell and Paul Moody were struggling in the adjoining town of Waltham to perfect their first power cotton loom, Ira Draper, son of Abijah Draper, an officer in the revolution, who, in 1808, had removed

to Weston, from Dedham, where he was born on December 29, 1764, was burning with zeal to perfect his loom temple and his loom, for, as was the custom of the period, his application for patent rights covered several different and distinct improvements, the most important of which was the loom temple. The patent granted him was a temple of the so-called star-wheel type, carrying a row of pins or teeth, which held the cloth, and so mounted on the breast beam as to render it largely self-acting. Up to the time of his invention, the temples in use were of the stretcher type, constructed of two pieces of wood, with teeth in the opposing ends. The weaver was obliged to insert these in the fabric and they had to be removed and readjusted as the temples traveled a short distance from the fell of the cloth. Thus Ira Draper pioneered in recognizing the need of a radical improvement, and to him goes full credit for producing the first rotary temple in the world. His invention enabled a weaver to operate two looms where before he had been able to tend but one. The present day Northrop automatic loom, first commercialized by the Draper Corporation, in 1894, allows a weaver to operate forty-eight looms, and on the more simple weaves up to a hundred.

For fifteen years following the receipt of his patent, Ira Draper studiously introduced his invention to the trade and on April 1, 1829, he was granted another patent on loom temples, covering an improvement on his earlier mounting devices. The following year he sold both patents to his son, James, who at once undertook to bring them to the attention of the cotton manufacturers of that era. James Draper was the first textile machinery producer to employ newspaper advertising in selling patented devices, his announcement appearing in the initial edition of the *Boston Transcript*, of July 24, 1830. In March, 1837, Ebenezer D. Draper, a half-brother of James, formed a partnership with the latter, and assumed control of the management of the firm.

THE BEGINNINGS OF HOPEDALE

In 1842 Ebenezer D. Draper moved to Hopedale, which at that time was a part of the town of Milford.

It was in this village that the Rev. Adin Ballou had established the famous Hopedale Community, the year before the coming of Ebenezer D. Draper.

In the failure of this movement, one finds concrete evidence of the futility of socialism, whose wrecks are strewn through the ages, to the present moment in Russia. Even when linked with a species of religious zeal and fervor it fails to function as was so clearly demonstrated in the Restoration Settlement, known as the Hopedale Community, and as set forth at great length in Adin Ballou's summarization of the origin, growth, decline and extinction of the communal effort made on the soil of this Worcester County town.

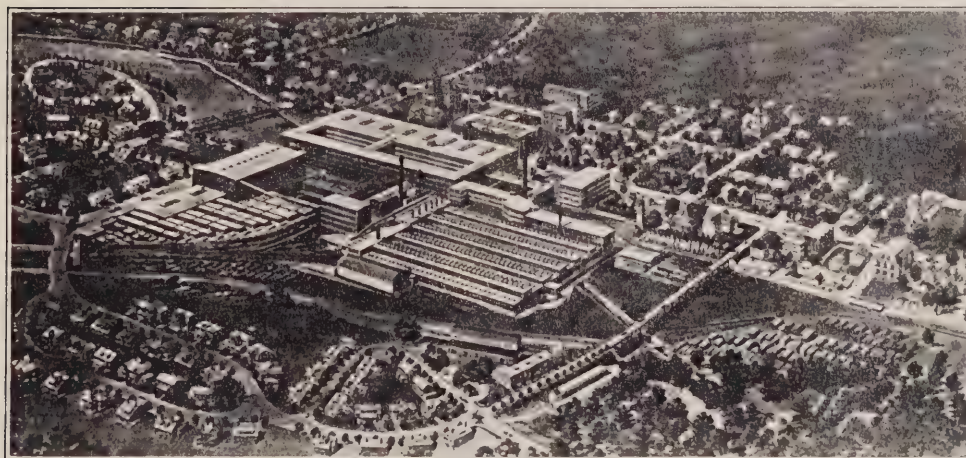
Its only epitaph may be said to be found in the origin of the great manufacturing industry that has carried the name of the town to operators of cotton textile plants throughout the civilized world.

For a period of fifteen years, between 1841 and 1856, the industrial endeavor of the Hopedale Community occupied the attention of its zealous supporters, and while the religious society went forward for a few years after that, its end was really written in 1856, when "Brother" Ebenezer D. Draper, then president of the Community, dramatically de-



“THE OLD RED SHOP”
 TWENTY BY FORTY FEET, WHERE THE PRESENT DRAPER
 CORPORATION WAS BORN, ABOUT 1845

The five windows on the left and the two on the end portray the original size, the buildings having later been increased to eighty feet in length. It stood near the shore of the pond where are now the North Works of the Draper Corporation



DRAPER CORPORATION, HOPEDALE, 1916

clared that the adherents of the movement could do better "for themselves and the world on the old financial plan than that of Christian Socialism"—thus tacitly admitting the failure of the Hopedale experiment and confirming the history of all previous attempts along similar lines.

The sincerity of Mr. Draper can scarcely be impugned and he at once went resolutely forward to demonstrate his conclusions. He and his associates abandoned "the less profitable branches of industry which had been carried on by the community, concentrated their resources on profitable ones in their own favorite line, called into partnership outsiders of inventive genius and capital, multiplied their productive facilities continually, brought out many valuable patents, and steadily ascended to eminence, as manufacturers of cotton and woolen machinery." Associated with the group was Warren W. Dutcher, an artisan of technical and alert mind and of great ability, and a genius whose productions soon placed the Draper concern on a firm and substantial plane in the manufacturing world.

GEORGE DRAPER'S WONDERFUL INVENTIONS

In 1853 George Draper, another son of Ira Draper, and who had led in the development of the high-speed spindle which exercised such a potent influence in bringing about the more general use of ring spinning in lieu of mule spinning, moved to Hopedale, and formed, with his brother, the partnership of E. D. and G. Draper—the firm forming the real foundation of the present great corporation, whose products cut in halves the cost of spinning, spooling and weaving.

Born in Weston, August 16, 1817, the industrial career of George Draper carries a lesson to the boy who holds the idea that only he succeeds who is born with the proverbial silver spoon in his mouth. From his fourteenth to his twenty-ninth year, George Draper was a weaver in a North Oxford cotton mill, next manager of the Union Mill, in Walpole, and two years later an overseer of weaving, in a small cotton plant at Three Rivers, in Palmer. It was here that he improved the temple his father, Ira Draper, had invented. The year 1839 found him out of employment, and rather than remain idle he entered the plant of the Massachusetts Cotton Mills, in Lowell, as an ordinary operative. He next became designer of fancy weaving in the Harris Woolen Company Mills, in Woonsocket, R. I., and from there went to one of the plants of the Otis Company at Ware, as superintendent. On October 28, 1840, and again on February 21, 1842, he was granted patents which embodied improvements on the same type of temple which his father had originally invented, in 1816.

During his active life upwards of one hundred patents for improved machinery and mechanical appliances were granted to him, and he was a conspicuous example of the successful inventor, combined with the able business executive.

John Thorp's invention of ring spinning, in 1828, came at a period when a spinning frame was built with four to not more than eight spindles and with but one side. With his mechanism as the basis, spinning frames have since been developed to a point where they are now built with up to 432 spindles, 216 on each side and with a speed of 10,000 turns per minute.

But to George Draper, more than to any other inventor, goes the

honor of developing the high-speed spindle, which caused ring spinning to supersede mule spinning.

THE DRAPERS PURCHASE THE DUTCHER PATENTS

In 1854 the firm of E. D. and G. Draper purchased the interest in two loom temple patents that had been granted to Elihu and Warren W. Dutcher, of North Bennington, Vt., on December 18, 1851, and December 28, 1852, which were of an entirely new type. The second invention was the more important of the two. The Dutcher temples were the first that were provided with cylindrical rolls, and were so constructed as to be reciprocated by the lay in the process of weaving, and held the cloth much nearer the last pick than any temples that had been produced up to that time.

A new firm was formed under the name of Warren W. Dutcher & Co., with W. W. Dutcher, and E. D. and George Draper as the partners. The new loom temples were manufactured at Bennington, Vt., until May, 1856, when Mr. Dutcher, who in his lifetime was the patentee of more than twenty separate basic and other improvements on temples and machines for manufacturing these devices, removed to Hopedale. A line of machines for setting temple teeth invented by Warren W. Dutcher is at present in use in the Hopedale plant, and stand unrivalled even today.

The importance of the Dutcher contribution to the textile art is attested by the fact that the Draper concern has continued the temple manufacture of the United States, without a departure from the basic principles of the original patents.

When, in 1856, the Hopedale Community had become hopelessly involved in financial difficulties, E. D. and G. Draper assumed its debts and assets, and they, with Joseph B. Bancroft, their brother-in-law, formed the Hopedale Machine Company to manufacture improved cotton machinery. It became necessary after the purchase of the Dutcher temple business to produce the high-grade castings required for the temples and for other machinery manufactured by the Hopedale Machine Company to provide a local foundry, and, in 1856, the Hopedale Furnace Company was formed as a partnership, and at that unit all castings were made for the various interests, as well as for the general trade.

In 1867 corporations were formed to take over the three partnerships—the Dutcher Temple Company, succeeding the firm of W. W. Dutcher & Co., and the Hopedale Machine Company and the Hopedale Furnace Company becoming incorporated entities.

In the earlier years of the partnership the Draper concern not only specialized in the production of temples, but in improvements of different motions on looms designed for plain weaving, the Bartlett, Shepard and Young let-offs and the Stearns Shuttle motion being introduced and adopted by a large number of mills. The Stearns shuttle motion represented the successful application of a patent granted to W. W. Dutcher, in 1846, in which the pioneer departure from the overhead pick motion took place, and it is today in universal use in the United States in modified forms. A large business was also developed in shuttle guards, thick and thin preventors, and other improvements to looms.

Ebenezer D. and George Draper continued the partnership until 1868, when the former retired and removed to Boston, and Gen. William F.

Draper, son of George, entered the concern, which became known as George Draper & Son.

IMPROVEMENTS IN TEXTILE SPINNING

It was about 1870 that radical improvements, of a far-reaching nature, were made in textile spinning. First came the Sawyer, next the Rabbeth, and then the Carroll double spinning ring—inventions which practically drove the more costly mule spinning out of America's textile plants, save in the very finest numbers. The reduction in cost of spinning operations as the result of these advances ran into the hundreds of millions of dollars and the savings were passed on to the consumers of textile fabrics.

In 1876 another change occurred in the personnel of the firm of George Draper & Son, when George A. Draper, another son of George, was admitted as a member and the concern became George Draper & Sons. Four years later, Eben S. Draper became identified with the firm as a partner, and in 1887, William F. Draper, Jr., and two years later, George Otis Draper, both sons of Gen. William F. Draper, entered the partnership. George Draper, who had been actively identified with the concern for thirty-four years, died on July 7, 1887.

Radical mechanical improvements and innovations took place in the Draper establishments during the '80s and '90s when extensive and expensive experiments were carried on for a period of twelve years by the organization, until in 1894, the world-famous Northrop automatic loom was made commercially possible, which, while not destroying the art of weaving, made it possible to accomplish the same results and to produce better fabrics by machinery than was possible by hand in India centuries ago.

In 1892 the Northrop Loom Company was organized, but it was not until two years later that the loom was placed before the textile trade in a commercial way.

THE NORTHROP LOOM

For more than thirty-five years the Northup loom has constituted the main product of the Draper Corporation, its inception, rapid development and manifest advantages having become matters of common knowledge in textile circles. It is provided for cotton production for everything woven with one shuttle, save the heavier grades of duck, and in the worsted and woolen fields it is used where one shuttle weaves prevail. This contribution to the art of weaving cut the cost of this process in halves, and the installation of a large number of patented devices has materially enhanced its value, a comparison of the present-day product with one of the original looms of 1894 providing evidence that the Draper Corporation has been active in the interim by the addition of cut gears, the use of lock washers, by grinding the take up roll to a specific size and by milling the loom-frames and girts.

Probably the major contributions to the art of weaving as embodied in the Northrop loom are the changing of filling by changing the bobbin in the running shuttle which took care of the problem of replenishing the filling; the first practical and successful warp stop-motion which would cause the loom to stop operating upon the failure of a warp thread, and the filling feeler, which was the natural result of perfecting the first two

elements where the quality of the fabrics permits no partial or double picks, and which changed the filling in the running shuttle before the supply became completely exhausted, thus producing perfect cloth.

The most significant feature in the development of looms has been the introduction of the automatic type, and the Northrop loom is the joint effort of five inventors who devoted several years to the task of producing a practicable automatic device. The fundamental principle was originated by Jonas Northrop, and the innovations embodied in the completed loom include:

1. A bobbin-changing device.
2. A filling topper from which bobbins or caps are automatically transferred to the loom shuttle.
3. A peculiar shuttle which can be threaded automatically by the motion of the loom.
4. Devices that act to stop the loom if the shuttle is not in position.
5. A warp stop-motion to prevent the making of poor cloth.

The most important of these is the weft changing device.

The shuttle is not changed when it has exhausted the thread on a bobbin, but the empty bobbin is automatically thrown out, and a full bobbin is automatically put in its place, the change being made so speedily that the loom is not retarded in its operation.

Thus the sum total of time formerly spent in the stoppage of the loom on account of exhausted shuttles is saved. On a non-automatic loom the shuttle has to be changed about every eight minutes or oftener.

SAVING 100 STOPS A DAY ON A LOOM

The Northrop loom stops only when a warp thread breaks, or when the shuttle is out of position, thus saving on the average about 100 stops per day. Then again the use of one shuttle eliminates a vast amount of labor in setting the pick, i.e., in adjusting the mechanism which drives the shuttle. The saving in the wear and tear of the machinery flowing from frequent stoppage is a large item, when multiplied by several hundred or thousand looms.

As a reliable warp-stop was required to make the Northrop loom practical, much experimenting was carried on in connection with this factor, and the final success stimulated an interest which resulted in the application of a similar device to plain looms.

The automatic threading device conferred upon the weaver a greater boon than perhaps had come to him since the invention of the first power-loom. Formerly he was forced to thread the shuttle from five hundred to a thousand times a day, sucking in the filling each time, and inhaling on each occasion not only more or less cotton lint, but sizing materials, dust and dye-stuffs, all of which were hazards to health. The automatic threading device stimulated other manufacturers to apply similar means to plain looms.

When first introduced in 1894 the Northrop loom could only use ring-spun filling, but by means of skewers mule caps were found to be as easily transferable to the shuttle as bobbins.

At the outset the use of the loom was confined to coarse, plain goods production, but later it was adapted to the weaving of fine fabrics, and to those involving complicated fancy patterns.

Instantly the original loom reduced the labor cost of weaving one-half,

and one weaver could tend from fourteen to thirty Northrop automatics, whereas before he was able to care for from but six to eight.

Within fifteen years after its introduction approximately 200,000 Northrop looms were installed in American cotton mills.

THE MERGER OF 1896

In December, 1896, the Draper Company was organized under the laws of Maine, and in it were merged the properties and assets of the Hopedale Machine Company, the Hopedale Machine Screw Company, the Dutcher Temple Company, the firm of George Draper & Sons, and the United States patents and business of the Northrop Loom Company. Prior to that date the Hopedale Furnace Company and the Hopedale Elastic Goods Company had been absorbed by the Hopedale Machine Company. General William F. Draper resigned his active connection with the corporation July 1, 1907, and died January 28, 1910. For many years he had charge of the finances of the partnership and corporation, and later he conducted the experimental department devoted to the perfecting of new inventions, including patents and patent litigation. For several years he was the practical head of the concern, and not a little of its success was due to his ability and activities.

At the beginning of the present century, the concern completely reconstructed its plant and provided central power and transportation facilities, the buildings covering more than thirty-three acres of floor space, and the complete layout presenting one of the most modern and up-to-date manufacturing units in the United States.

It ranks today as the largest producer of cotton machinery in the United States, and the largest manufacturer of cast metal parts in New England.

THE CORPORATION'S GREAT CONTRIBUTIONS TO THE TEXTILE ART

Among the more striking important improvements in textile machinery offered to the world during the last thirty-five years by the Draper concern have been not only the automatic loom, but the hand knotter, the automatic distributor for cotton openers, and warp-drawing and warp-tying machines.

The following devices all came under the control of Hopedale interests at some period of their patent existence:

1816—First loom temple of Ira Draper patented in the United States.

1829—Revolving loom temple improvements patented by Ira Draper.

1840—Important temple improvements patented by George Draper.

1846—Parallel shuttle-motion patented by W. W. Dutcher.

1850—Hayden's patent for railway-head evener granted.

1850—Reciprocating temple patent issued to Elihu and W. W. Dutcher.

1852—Important improvement in loom temple patented by Elihu and W. W. Dutcher.

1857—Snell and Bartlett's let-off patent issued.

1859—William Stearns' shuttle-motion patent granted.

1862—Silas Shepard's let-off patent allowed.

1862—Card-guide patent issued to Hervey Kent.

1863—George Draper's loom stop-motion patent granted (This device is used on every side dagger loom in the country).

- 1866—First spindle patent granted to J. E. Atwood.
1867—Cottrell & Draper's double beam let-off patent granted.
1867—Important spindle patent granted to Rabbeth and Atwood.
1868—W. F. Draper's thin place prevention patent for looms issued.
1868—First American self-threading shuttle patent granted to J. A. Metcalf.
1868—Patent issued to F. Haythorn for the first spinning frame separator.
1869—First bobbin-holder patent granted to A. M. Wade.
1869—Double flange spinning-ring patent issued to W. T. Carroll.
1869—First inside-catch shuttle patent granted to J. H. Coburn.
1870—Patent issued on the original Walmsley warper stop-motion.

In addition to the patents granted to George Draper that are enumerated in this list his more important patented inventions include the parallel shuttle motion, a new form of let-off motion, spinning frame separators, the shuttle-guard for looms, self-lubricating bearings for spindles, double-adjustable spinning rings, slasher warpers, bobbin holders for spooling and high-speed and power-saving spindles, which produced double the quantity of yarn previously made. It is estimated that his improvements in speed and in the power utilized resulted in economy of power sufficient to equal two water-powers such as exist on the Merricac River, at Lowell.

THE PROGRESS IN THE FIELD OF SPINDLES

The spindles manufactured at Hopedale are based on the inventions of Francis J. Rabbeth, the pioneer producer of the self centering spindle, now in general use here and abroad, and the product includes his latest spindle with its centrifugal clutch drive. The concern also produces the Draper type of spindle, the McMullan and the Whitin, or gravity spindle, and the model made under the patent of Charles E. Lovejoy.

Closely identified with the introduction and adoption of the separator the concern has become the largest manufacturer of these devices, the Rhoades-Chandler type brought out by it having superseded the earlier Doyle invention, and is now the recognized standard.

The double flanged spinning ring, patented in 1869 by William T. Carroll was introduced by the old Draper organization and has been manufactured in increasing quantities for many years, and in recent times these rings have been vastly improved by the use of machines and processes invented by Frank H. Thompson, one of the superintendents at the Hopedale plant.

Shaw and Flinn's lifting rod cleaner, the Speakman loom screw, the band tension scale, the Rhoades patent banding machine, which combines all the features of the original Weeks and Watters marking attachment, and two patents issued to Rhoades; the Hastings patent metal bushed bobbin, patented by Walter M. Hastings, of Methuen; the Duckworth patent traveler magazine; the Moscrop patent single thread yarn-testing guide; the Wade bobbin holder and the adjustable thread guide, both of which have been greatly improved by the company's inventors, within recent years; the Lawrence patent bobbin holder; the improved Northrop, Lawrence, and MacColl guides; the Rhoades patent side-eyestrings bobbin holder; the Bourne and Johnson spooler tenders' knot trimmer, cotton bale shears, belt hole guards, originally patented by B. L. Ward, and oil-cans,

first patented by Thompson and Getchell, are also among the company's products.

More than fifty-five years ago the concern began the production of warpers, and soon after the invention of the slasher, and in the intervening time it has introduced practically all of the improvements which are found on modern warpers, including the Hicks cone drive which increased production, the Walmsley stop motion, the Rhoades beam doffer, the most effective expansion combs, the glass creel stop and the straw breakage recorder, as well as the Walcott chain warper, the Rhoades balling machine, the Morrill and Rhoades patent slasher combs, the Straw winding machine, unwinding machines, equipped with the Connelly patent regulating device, are regularly produced at the Hopedale plant.

Fifty years ago, after the introduction of the Sawyer spindle, recognizing the call for an improved twisting machine, the company's inventors designed and placed on the market the first twister carrying high-speed spindles, and since that time the concern has brought out many other improvements including the Rabbeth spindle, the box rail construction for twister frames, the Hetherington spindle brake, the all-metal top and creel, the Smith stop motion, the Rhoades novelty yarn attachments, adjustable feet for sampsons, the Carter oiling device, as well as standard reels.

RECENT CORPORATION DEVELOPMENTS

The influence of the officials of the Draper Corporation upon the development of the town of Hopedale, which was set off from Milford, in 1886, has resulted in the creation of an industrial municipality unique in conception and execution. Housing conditions are ideal, there being scarcely two residences alike, and all are equipped with the most modern conveniences, while the well-shaded surfaced streets, outstanding municipal buildings, one of the finest community-houses in the country, equipped with gymnasium, shower-baths, bowling alleys, rifle range, auditorium, kitchen, men's and women's social rooms, the library, hospital and fine school buildings, all attest the wisdom of scientific municipal planning, and bring the town into a class by itself.

At the Paris Exposition of 1900, the company was awarded a silver medal for its policy in offering improved dwellings for its employees, while gold medals were awarded it at the St. Louis Exposition, in 1904, at the Liege Exposition, in 1905, and at the International Exposition, at Milan, in 1906, for its stellar contributions along this line.

On April 9, 1914, occurred the death of Eben S. Draper who had served the Commonwealth as Lieutenant-Governor from 1906 to 1909, and as Governor, from 1909 to 1911, and on February 7, 1923, George A. Draper died.

In July, 1927, came the last material change in the extension of the company's business when it bought the assets and business of the Hopedale Manufacturing Company of Milford, which was capitalized for \$785,900, and employed 525 operatives. Jonas Northrop was president, Frank E. Norcross, secretary, and Claire H. Draper, treasurer, of this unit and they, with George Otis Draper and Randolph Crompton constituted the board of directors. The concern was a large producer of automatic weaving machinery, and operated a branch factory in Hopedale.

B. H. Bristow Draper, the present treasurer of the corporation is

of the fourth generation from Ira Draper in direct line, being the elder son of the late Governor Draper. Frank J. Dutcher is president, and G. Russell Goff, secretary.

The Draper Corporation has capital of \$17,500,000 and employs 3,000 operatives.

THE INDUSTRIES OF LANCASTER

To Farnham Plummer, of Lancaster, the improvement in the manufacture of combs, which came about in the latter years of the first quarter of the last century, was largely due, as he invented a machine capable of cutting 120 dozen side-combs a day, ejecting simultaneously two combs from a square piece of horn. The circular saw, which had been used previously, cut but one tooth at a time, and the new machine reduced the time required nearly fifty per cent, and the stock, one-third, and it was so constructed as to cut combs of any size. From the labor angle, the saving was even more pronounced. John Lowe introduced the comb industry to Lancaster, and in 1826 there were fifteen or more comb-making establishments in the town, employing in the aggregate at least fifty persons, and turning out products that sold for between \$15,000 and \$20,000. Henry Lewis, Haskell McCollom, Anson Lowe, Enoch K. Gibbs, James S. Lawrence, Charles Miller, N. C. Munson, Charles Frazer, Levi Pollard, Jose Sawtelle, George Howard, Nathan Burdett, Emory, Asahel, and Sidney Harris, were among those who were prominent in the now abandoned local manufacture of combs.

The Ponikin Mills, which, until recently were devoted to the production of cotton yarns, passed in 1928, into the hands of Albert C. Moulton, of Worcester, formerly of Rutland, and are being operated with fifty hands, by the Moulton Textile Company, Inc., which has capital of \$45,000.

The purchase included a 125-horse-power privilege on the north branch of the Nashua River, two large mill buildings, storehouse, power plant, five tenement houses and fifty-four acres of land, formerly owned by the heirs of Walter F. Stiles, of Fitchburg.

Woolen goods and satinets are now manufactured in lieu of the cotton spinning formerly carried on there. Albert C. Moulton is president, and M. Greta Moulton Marean is vice president, clerk and treasurer.

E. E. Miles, now owned by Walter E. Miles, employs eighty operatives in the manufacture of pocket dictionaries, diaries and albums, while George T. and Harry S. Beckner, as partners operate the Beckner Feather Duster Company engaged in the production of ostrich feather dusters.

LEICESTER—THE CENTER OF CARD MANUFACTURE IN THE UNITED STATES

Up to the beginning of the Civil War, the town of Leicester was the principal center of card manufacture in this country, and it had enjoyed this distinction for three-quarters of a century before.

About 1780, Thomas Earle settled there and at that period he was regarded as the equal of any expert in the United States in that line of production.

The town then boasted of a carding factory, where both woolen and cotton cards were made by a force of fifteen or twenty men, and where annually between 12,000 and 15,000 pairs of cards were fabricated.

A trip-hammer was the only other local industry of that time. Edmond Snow was one of the pioneer local inventors of card machines,

which he first placed on the market, in 1785. Pliny Earle began business there in 1786, and three years later made for Almy & Brown, of Providence, R. I., the first machine card-clothing ever manufactured in America. The statement is frequently made that Earle produced the first machine for Samuel Slater, but the Almy & Brown device was delivered and set up some time before Slater started his cotton operations, at Slatersville, R. I.

In 1797 Earle invented a machine for picking twilled cards, and when he was succeeded by his sons, T. K. and Edward Earle, they not only contributed important improvements of their own invention to the original card-clothing machines, but also began the manufacture of oak-tanned leather belting.

Machines for forming the teeth used in the cards were in use during the early years of the 19th century, and although most of the wire was imported, a factory for the manufacture of that product was set up in Leicester, driven by a windmill, and as early as 1812 eighteen hands were on the roll.

Daniel Denny began the manufacture of cards by hand, in Leicester, as early as 1792 and ten years later Winthrop Earle was engaged in producing machine cards, being succeeded by John Woodcock, who invented a machine for splitting leather. In 1812 he became identified with the firm of Woodcock & Smith, and in 1825 the name was changed to Woodcock, Knight & Drewer. In 1868 the next generation of the Woodcock and Knight families assumed control of the business and in 1881 sold their interests to the Card-Clothing Association.

In 1810, Messrs. Southgate and Sargent began the manufacture of machine cards, and in 1843 the firm became Bisco & Denny.

Due to the inventions of Joseph D. Sargent, the junior member of the original firm, who at first used dog power for cutting the teeth by machinery, many persons living in Leicester and vicinity were engaged in card production. The teeth were put up in bags, and distributed to families, whose members stuck them into the leather, and returned the product to Sargent's factory. Frequently, he sent out the work as far as twenty miles, men, women and children engaging in it as their sole occupation.

The original Sargent Card-Clothing Company ultimately removed to Worcester, where, in a larger factory, 3,600 square feet of card-clothing were turned out in a single day in the seventies, this plant then producing one-fifth of all the machine cards made in Worcester County, in 1872.

THE FIRST EMERY MANUFACTURER

The first manufacture of emery in the United States was attempted, in Leicester, about 1812, by Pliny Earle & Co., the card-makers, the raw material—corundum—and other materials, having been found in granite and other primitive rocks, in Connecticut, New York, Pennsylvania, and Maryland.

It is an interesting coincidence that three-quarters of a century later, the adjoining City of Worcester in a large way entered upon the production of emery commodities, through the activities of what today is internationally known as the Norton Company.

Josiah Q. Lamb, Alonzo White, H. A. White, Josiah D. Murdock, Jr., Baylies Upham, James and John A. Smith, Benjamin and Austin Conklin,

Claramon Hunt, John H. and William Whittemore, Joseph B. and Edward Sargent, and L. S. Watson were among the names of other local card manufacturers whose products brought fame and wealth to them and to the town, during the latter years of the eighteenth century, and practically the whole of the nineteenth.

Previous to 1814 Samuel Watson began the weaving of woolen cloth, in Leicester, on looms operated by hand. His mill was destroyed by fire, in 1848.

Thomas Bottomley was the real founder of the village of Cherry Village, where, in 1821, he erected a woolen mill, which was bought in 1874 by the late George W. Olney, the intervening owners being George Hodges, B. A. Farnum, George H. Gilbert, Jr., H. C. Weston, Frank C. Fiske and Albert T. B. Ames.

In 1821, James Anderton began the manufacture of broadcloth and cassimeres in the southerly part of Leicester, the plant being successively owned and operated by the Leicester Manufacturing Company and by Saxon & Leicester Company. In 1829, Joshua Clapp bought the mill, and in 1846, when it was burned, Messrs. Barnes & Manson were the owners. Messrs. Barnes & Denney rebuilt on the site, but the brick structure erected by them was destroyed by fire, in 1851, and rebuilt the next year.

Johnson, Sewall & Co., bought the site in 1856. In 1838, Messrs. Earle & Warren began the manufacture of satinets, in the village of Mannville, but suspended operations in 1875, and four years later George and Billings Warren reopened the plant and enlarged it.

In 1836 Thomas Bottomley began the manufacture of broadcloth in what subsequently became known as the Cherry Valley Woolen Mills, E. L. Capron, Messrs. Lapham and Smith, Collier & Smith and the Cherry Valley Woolen Mills Company were the successive title owners.

In 1844, Jonathan Earle built a satinet mill in the town, which was burned in 1848, then rebuilt and leased to Messrs. Baker & Bellows. In 1853 Eli Collier bought the property, and operated it until 1866 when it was burned. It was rebuilt later and Collier bought the property again in 1888.

The Chapel Mill was built in 1836-37 and churns were first manufactured there, followed by shuttles, and wire drawing in after years. In 1854, shoddy was produced and later satinets were made there by Messrs. Bottomley & Fay. Burned in 1865, it was rebuilt by Samuel Chison, of Newton, and when again destroyed by fire in 1887, Messrs. Collier & Butler bought the site and built a new mill.

The concern of A. Hankey & Co., continued a business established by Caleb Wall, in 1798, when he began the manufacture of scythes. In 1848, Hankey, Stiles & Co., acquired the plant, and tools and forgings were produced there up to within a few years past.

THE L. S. WATSON MANUFACTURING COMPANY

In 1842, the late L. S. Watson established the L. S. Watson Manufacturing Company which has carried on, without interruption and with members of the founder's family in managerial positions for almost ninety years, the manufacture of hand cards, wire heddles, shuttles and heddle frames of all descriptions.

Associated with it, but operating as a separate corporate entity, is the J. H. Williams Company of Millbury, which was established in 1830, and which specializes in shuttles and heddle frames.

Further proof that age does not wither nor custom stale nonagenarian industrial enterprises in Massachusetts is found in the fact that the L. S. Watson unit entered the field of sporting goods production a few years ago and today a considerable percentage of its product is represented in the manufacture of cards and brushes for all breeds of dogs, these commodities being marketed in attractive form, with ducoed backs in various colors.

The corporation has capital of \$125,000, and employs seventy-five operatives. Walter C. Watson is president and treasurer, and he is also president and treasurer of the J. H. Williams Company, of Millbury.

THE CHANNING SMITH TEXTILE CORPORATION

The history of the Channing Smith Textile Corporation runs back to 1857 when the Smith family purchased the small plant, in Cherry Village, known as the Valley Woolen Mill.

On March 30th, 1876, when the Lynd Brook Reservoir gave way, great property damage and financial loss were suffered, but surviving this disaster, the small mill continued in business.

In 1892 A. E. Smith and his son, Channing, as partners, founded this unit as the Valley Woolen Mill. It was then equipped with four sets of cards and forty-eight narrow looms, since increased to seven sets of 48x48 cards, with enough spinning and full equipment to take care of the operation of 114 looms, and it has a weekly production of about 30,000 yards of cloth. About that year the Messrs. Smith originated a cotton-warp suiting flannel—a fabric adaptable to the manufacture of woolen shirts, to take the place of an all wool flannel. Known as Cherry Valley shirting flannels, the goods met with huge success and millions of yards have been produced.

With their earnings from this mill, they purchased two other plants in Cherry Valley, known as the Brick City Mill and the Chapel Mill, the latter being bought in 1897. The Brick City Mill was acquired in 1903, and, combined with the Chapel Mill, the Chapel Mills Manufacturing Company was formed, with a capital of \$300,000. This unit added a weekly production of approximately 45,000 yards. Practically all the earnings were gradually reinvested in plant and equipment to meet the growing demand for the company's products.

In July, 1923, the Chapel Mills Manufacturing Company, and the Valley Woolen Mill were amalgamated into the Channing Smith Textile Corporation, with an authorized capitalization of \$1,000,000, of which \$450,000 is outstanding, giving the new corporation twenty sets of woolen cards and 302 narrow looms, with a complete equipment of finishing and dyeing machinery.

The present organization continues the production of the flannels, but more particularly specializes in the manufacture of thirty and thirty-six inch cotton warp cloakings and suitings, doing a yearly business of close to \$2,000,000, and employing 600 operatives. J. A. B. Taylor is president, Lewis W. Everett, treasurer, and G. H. Mirick, assistant treasurer and secretary.

LEICESTER'S OTHER INDUSTRIES

In 1880, the J. D. Clark Company was established in the village of Rochdale, for the manufacture of woolens, and was incorporated in 1895, with capital of \$20,000, since increased to \$56,000.

The present-day product is shirting, and the plant is equipped with five sets of cards, fifty-six looms, 936 woolen spindles, two pickers, complete dyeing and finishing units, a boiler, and two water-wheels, and employs seventy-five operatives.

Arthur C. Comins is president; Irving E. Comins, treasurer; Edward J. Comins, secretary, and D. W. Fox, superintendent.

Comins & Co., Inc., established in 1884, while receiving its mail in Rochdale, has its plant within the corporate limits of the town of Oxford, and its history is carried in the section of this chapter devoted to the latter town.

E. G. Carlton & Sons have long produced white flannels, at its Rochdale plant, which is equipped with six sets of cards, sixty broad looms, a boiler and a water-wheel. In 1928 a substantial two-story brick addition, of modern mill construction, was erected, 62 by 14 feet, in which additional machinery was installed. The concern is owned by Everett Carlton, and upwards of 100 hands are employed.

The Rochdale Mills, of the American Woolen Company are equipped with 6,720 spindles, sixteen sets of cards, eighty-six looms, three boilers and a water-wheel.

The Leicester Woolen Company, owned by Charles R. Ashworth, employs fifty operatives in the manufacture of chinchillas and suitings. The plant is equipped with two sets of cards, forty narrow looms, 864 spindles, complete dyeing and finishing units, a boiler and a water-wheel.

The Russell Manufacturing Company with capital of \$50,000, is engaged in the production of toys and games. C. C. Harris is president, W. L. Hubbard, secretary, and Ralph Russell, treasurer.

MENDON'S EARLY INDUSTRIAL ENTERPRISES

As early as 1672 Mendon had a corn mill and ten years later a saw mill was built on Muddy Brook.

Previous to 1793, a bloomery forge was set up in the town, and, in 1808, the Blackstone Manufacturing Company began the erection of its cotton plant there, and by 1822 the plant was equipped with 150 power looms, 6,000 spindles, and completely equipped bleach and dye houses.

Seth Wheaton was the prime mover in the enterprise, and when the mill was built it was one of the largest, if not actually the most extensive factory, that had been built in Massachusetts up to that time.

The plant was of stone, 211 by 40 feet, six stories high, and had a capacity of 10,000 spindles. It began operations in November, 1809, with 5,000 spindles—a larger number than were then in operation in any plant in the country, save those of Almy, Brown & Slater, at Slatersville, R. I., and at the factory of the Union Manufacturing Company, of Maryland. When the town of Blackstone was set off from the town of Mendon the concern became a part of the industries of the former municipality.

MILFORD'S INDUSTRIES

In 1837, 128,000 pairs of boots were manufactured in Milford, valued at \$213,000, by 342 employees; 4,000 straw bonnets were made there,

valued at \$12,000, and one cotton mill, with 1,200 spindles, wove 80,000 yards of cloth, valued at \$5,000.

By 1845 the industrial production of the town was valued at \$350,000, and ten years later it had risen to \$2,000,000 with shoes constituting the principal line, the plants being valued at \$200,000, and the payrolls exceeding \$60,000 weekly.

Colburn, Fuller & Co., Charles W. Shipper, Claflin & Thayer, James S. Kelley, Charles F. Quiggle and R. E. Foster & Co., were prominent in the local industry, at that period, and Benjamin H. Spaulding and Jones & Wilkinson, were manufacturers of straw goods. In 1890, C. A. Sumner began the manufacture of shoe racks.

THE F. W. MANN COMPANY

The F. W. Mann Company had its beginnings in 1877, but the firm of Chapman & Mann was not formed until 1886, the senior member retiring the following year.

Its production program is another illustration of the versatility of Massachusetts inventors and manufacturers in adapting themselves to changing conditions and demonstrates their ability to meet common demands.

For years its green bone cutters were a boon to poultry raisers, and enjoyed almost a monopoly of the market, so effective were they in operation. With the coming of the automobile came the invention and addition of auto jacks, and still more recently the concern has invaded the field of water heaters. It is capitalized for \$20,000.

J. R. Kimball is president, L. M. Vesey, vice president, W. B. McFarland, secretary, and P. S. Kimball, treasurer.

THE MILFORD IRON FOUNDRY

In 1886, C. N. Welch and E. E. Goff formed a partnership to operate a gray iron foundry, in Franklin, employing ten or a dozen men. Most of the early product was manufactured for a local machinery manufacturing company, from which the buildings were hired.

Progress at the end of six years was such that, requiring larger quarters, the business was moved to Milford, into a new and larger plant where it is now located.

In 1893, Mr. Welch bought the Goff interest and continued for some years as sole owner, and later as president holding the controlling interest until his death, in 1915.

In 1895 the name of the concern was changed to the Milford Iron Foundry, and three years later the business had grown to a point where an addition to the plant was required.

In 1903 the company was incorporated under the laws of Massachusetts, and H. L. Welch, son of C. N. Welch, and E. C. Bailey, at that time foreman and a man of wide and practical foundry experience, became officers of the concern.

The business continued with steady and consistent growth adding to its line and increasing its customers, and following the death of C. N. Welch, operations were continued by E. C. Bailey as president and H. L. Welch as treasurer, the family interests remaining as before. This personnel remains the same today with the addition of young men who have grown up with the business and the directorship now comprises the

above officials and W. R. Bailey, son of E. C. Bailey, G. A. Sweet, the superintendent and R. L. Roy.

From only a few tons of product per week, in 1886, the concern has grown to its present capacity of forty tons per day and rates as one of the largest jobbing foundries in New England. It has a capitalization of \$233,000.

The company has specialized in fine high-grade castings for machinery builders, and is equipped to render grade and service from the smallest to an eighteen-ton casting. It employs three hundred men.

In 1929, material additions to plant and equipment were made, making the concern one of the most modern and up-to-date foundry units in New England. H. L. Welch is treasurer and secretary, and E. C. Bailey, president of the corporation.

THE DODDS GRANITE COMPANY

In 1887 the Milford Pink Granite Company was established, and was incorporated the following year, to quarry and market the celebrated pink granite found in the vicinity of Milford, which for generations has been favorably regarded by architects and builders because it is easily and economically worked, susceptible of high polish, and in appearance exceedingly attractive. Fifty acres of land were acquired by the company, which are now the property of the Dodds Granite Company, of Milford, which has capital of \$1,000,000 and employing 300 hands, ranks as one of the largest present-day industries of the town. Established in 1864 it operates quarries and manufacturing plants in three New England states—one in Milford, another in Keene, N. H., and a third in Stony Creek, Conn. At the Milford plant, the world famous Milford pink granite is exclusively quarried by the concern, while at Keene the Victoria white granite is produced, and at the Connecticut plant, the Stony Creek granite is harvested. The company has its New York headquarters in the Pershing Square Building, and its Chicago studios in the Builders' Building, corner of LaSalle Street and Wacker Drive. Some of the finest memorials and monuments in this and other countries have been erected by the corporation.

John Charles Dodds is president, Earle C. Dodds, vice president, general manager and treasurer, and Charles A. Bone, secretary.

William Lapworth & Sons, owned by William Lapworth, is engaged in the manufacture of elastic and non-elastic fabrics, and employs 125 hands. The plant is equipped with eighty-eight narrow looms.

The Alhambra Rubber Company employs fifty operatives in the production of rubber raincoats, Arthur Webb being president and Fred W. Fitzsimon, treasurer and secretary, of the corporation.

The Archer Rubber Company employs 500 operatives in the manufacture of raincoats and rubberized fabrics, and has capital of \$600,000. J. T. Callahan is president, and F. P. Lee, treasurer, of this fast growing local enterprise.

The S. A. Eastman Company produces paper and corrugated boxes, employing forty operatives. G. C. Eastman is president and treasurer, and E. W. Adams, secretary of the corporation, which has capital of \$25,000.

Dies, tools and metal stampings constitute the products of the A. J. Knott Tool & Manufacturing Company which has capital of \$50,000. A.

J. Knott, is president, J. H. Parmenter, secretary, and P. V. Stroud, treasurer. The concern employs forty hands.

W. D. Mann & Co., owned by James V. Mann, produce wool substitutes, cotton and wool, and carry on the dyeing of raw stock, at a plant, in South Milford, where twenty-five operatives are employed.

The Milford Shoe Company is the town's largest employer of labor, utilizing the services of upwards of 500 operatives in the production of men's footwear. The concern has capital of \$200,000 and surplus and maintains a Boston office, at 10 High Street. P. O. MacBride is president and treasurer, and F. W. Frost, assistant treasurer.

The year 1929 witnessed the accession of a number of new concerns.

The Monarch Novelty Company, operating factories in Woonsocket, R. I., and in Ware, in this state, began the occupancy of a part of the factory formerly occupied by the Hixon straw hat plant, and began production there.

Lyons & Hershenson, Inc., of Chelsea, transferred its machinery from the latter city to the former four-story Huckins & Temple shoe factory, in Milford, and began the manufacture of shoes with upwards of 300 operatives. The plant had been idle since May, 1927, when the Huckins & Temple concern liquidated. The new company employs nearly 500 operatives and has capital of \$200,000.

The Carroll, Hixon, Jones Company, Inc., purchased the Smith Mills, on North Bow Street, and removed its machinery from Medway to Milford, where 250 operatives are employed in the manufacture of straw hats. Charles D. Hixon is president and treasurer, Carroll J. Hixon, vice president and Wendell Williams, secretary.

The Edwin S. Pickert Company of Foxboro, now operates a branch plant, in Milford, in the production of straw hats. At its Foxboro and Milford factories it employs 150 operatives and has capital of \$70,500.

THOMAS BLANCHARD—INVENTOR OF THE WORLD FAMOUS
BLANCHARD LATHE

From Millbury have emanated some of the great inventions of the last one hundred years, extending from the small shuttle-eye to the large eccentric lathe, and from the peaceful pen-knife to the gun powder of the battlefield.

Thomas Blanchard, the inventor of the lathe for turning irregular forms which bore his name, was born in Sutton, June 24, 1788. His brother was engaged in manufacturing tacks by hand, and young Blanchard, before he was eighteen years of age, attempted to invent a machine to manufacture these commodities. After six years of experimentation, he succeeded so effectively that by placing in the hopper the iron to be worked, and applying the motive power, five hundred tacks were made per minute, with better finished heads and points than had been made by hand. Patenting this machine, he sold the right of manufacturing it to a company for \$5,000. On May 4, 1813, he was granted a patent on a horizontal shearing machine.

He then turned his attention to the construction of a lathe to turn musket barrels, with a uniform external finish from end to end, by the combination of one single, self-directing operation. Notwithstanding about three inches of the barrel at the breech is partly cylindrical and

partly equipped with flat sides, both were cut by this machine, which ingeniously changed to a vibrating motion as it approached the breech. The superintendent of the Springfield Armory learning of the invention, contracted with Mr. Blanchard for one of the machines. When it was in operation, one of the workmen remarked that his work of grinding the barrels was ended. Another, employed on the wooden stocks, which were then all made by hand, said that Blanchard could not spoil his job, as he could not produce a machine to turn a gun stock. Blanchard answered that he was not sure that he could evolve such a device but he would think about it. The basic principle of the machine was that forms were turned by a pattern, the exact shape of the object to be produced, which in every part of it was successively brought in contact with a small friction wheel; this wheel precisely regulated the motion of chisels arranged upon a cutting wheel acting upon the rough block, and as the friction wheel successively traversed every portion of the rotating pattern, the cutting wheel pared off the super-abundant wood from end to end of the block, leaving a precise resemblance of the model. This remarkable machine, with modifications and improvements has been in use in all the national armories, as well as in England, and in various forms was applied to many operations in making musket stocks, such as cutting-in the cavity for the lock, barrel, ramrod, butt plates, and mountings and comprising, with the turning of the stock and barrel, in not less than thirteen different machines. Besides gun stocks, it was also applied to a great variety of irregular forms, such as shoe lasts, handles, spokes, hat, tackle, and wig blocks.

On September 6, 1819, Blanchard was granted letters patent on his great invention, which was to have a profound and far-reaching effect upon American manufactures, and which became internationally known as the Blanchard lathe.

By special acts of Congress, in June, 1834, and again in 1848, renewals of his petition were granted, which did not expire until January, 1862.

While employed at the Springfield Armory, Blanchard originated thirteen different machines afterwards generally adopted in the manufacture and stocking of firearms. The old shop in which he invented the eccentric lathe was located in the third water privilege, on Ramshorn stream, and was torn down in 1889, when a new factory was built on the site, which was burned in 1900, but was rebuilt.

In 1831 he received a patent on an improved form of steamboat, so constructed as to enable a vessel to ascend rapids, or rivers having strong currents. This invention was quite generally employed in this Commonwealth, and in the west.

He initiated several improvements in the construction of railroads and locomotives, and was the inventor of a "steam wagon" before any railroad had been built.

In 1851 he devised a process for bending strip timber, upon which he received a patent. He also conceived and constructed a machine for cutting and folding envelopes at a single operation, and several mortising machines.

During his lifetime he received no less than twenty-four patents, but like many another inventor, he realized little in the way of pecuniary reward for his valuable contributions in the field of mechanics.

THE INDUSTRIAL MILLBURY OF NINETY YEARS AGO

In 1837, the manufactured products of Millbury were valued at \$515,775, the town having six woolen mills at that period, employing 272 persons, and turning out 160,000 yards of cloth; one cotton mill, with 1,848 spindles, employing forty hands, which produced 350,000 yards of cloth; a musket factory, employing thirty, which made 2,500 muskets annually; a scythe factory, producing 14,400 scythes, several shoe concerns, which manufactured 9,800 pairs of boots and 80,500 pairs of shoes, and a paper mill, whose annual product was valued at \$15,000.

The only powder mill located in that section of Worcester County was built in Millbury in the early days of the Revolution, and the paper mill was the only industry of that type in central Massachusetts. The first brass foundry, built outside of Boston, was established in the town by Asa Kinney, Jr.

It was in Millbury that William Crompton perfected his loom which so revolutionized weaving throughout the world, and which materially lessened the price of clothing in all civilized countries. Here, also, Asa Waters, II, invented the process of welding gun barrels under a trip-hammer and also a lathe for turning out gun barrels of regular size, a device somewhat different from Blanchard's lathe for irregular forms. Hervey Waters invented in the town a pin-making machine and still another device for sticking the pins into paper in rows, as well as a process of rolling scythe and bayonet blades which largely eliminated hand labor.

Thomas Kendall, Jr., a Millbury man, first made the thermometer a useful instrument and Ichabod Washburn locally began the manufacture of wire, the production of which was later transferred to Worcester. It was in Millbury that he inaugurated the series of experiments, which eventuated in the art becoming practical.

In the early days of the republic, when it was deemed popular for statesmen to appear in clothing of American manufacture, Henry Clay, on a visit to Millbury, was given a roll of blue broadcloth produced at Colonel Sheppard's mill, while Daniel Webster wore a suit of clothes made from cloth turned out by the Goodell Manufacturing Company, of Millbury, presumably woven on looms made by W. H. Howard, of Worcester.

LOCAL ENTERPRISES OF THE LAST QUARTER CENTURY

In 1897 the Mayo Woolen Mills Company was incorporated and today has capital of \$500,000, employing 425 operatives in the manufacture of men's wear woolens, suitings and cloakings. The modern plant is equipped with eighteen sets of cards, 111 looms, and seven boilers.

F. H. Meserve is president; T. P. Curtis, vice president; J. P. Southern, treasurer, and Oscar Dietrich, agent.

The West End Thread Company was established about 1895 and was incorporated under the laws of Maine in 1910 to manufacture linen and cotton threads. It was incorporated as a Massachusetts corporation six years later, and today employs 150 operatives. The plant has its own modern dyeing department, and is equipped with two boilers and a water-wheel.

Hon. W. M. Butler is president; Robert B. Stone, clerk and Talbot C. Chase, treasurer. The company maintains its Boston office at 183 Essex Street, and has capital of \$1,000,000.

The corporation manufactures a complete line of cotton and linen threads, used in the shoe repair and harness trades, its various brands being well and favorably known.

In 1902, the Holbrook Mills Company purchased the plant of The John Rhodes Warp Company and engaged in the manufacture of crash toweling.

In 1904 title to the property was transferred to Francis H. and Edward F. Rice, under the name of Edward F. Rice & Co., and mercerized cotton damask napkins were manufactured until 1922. In 1917, after the death of Francis H. Rice, the partnership was changed to a corporation, under the name of Holbrook Mills Company, which has continued to the present, and in 1922 the ninety-two looms were retied for dress-goods and drapery material, which are the present products, and include bed-spread, corset and tapestry goods.

Edward F. Rice is president and treasurer and Frederick W. Hooper, secretary of the corporation, which has capital of \$100,000, and employs fifty operatives.

Warren B. Harris purchased the Millbury Machine Company in 1907 and three years later bought the Rice Dobby Chain Company. Starting with three employees and 4,000 square feet of floor space, he now employs twenty-five men and utilizes nearly 10,000 square feet of area. The corporation has capital of \$75,000 and Mr. Harris is president and treasurer.

THE J. H. WILLIAMS COMPANY

Founded at Utica, N. Y., in 1830, where it remained until January 1, 1909, The J. H. Williams Company is another corporation that found it desirable to change its habitat to Massachusetts, removing to Millbury on that date, where it carries on the manufacture of shuttles, wire heddle and heddle frames in approximately 25,000 square feet of area, employing 100 operatives.

At that time, the concern was merged with the H. W. Hakes Manufacturing Company and later the latter concern became a part of the Williams Company and remained under the management of H. W. Hakes until 1919, when A. O. Buzzell became general manager, in which capacity he continued until his death on December 25, 1922. Clifton E. Watson succeeded him in that position.

The Williams Company is well known among the textile mills for its quality shuttles and heddle frames. Shuttles are made for the weaving of cotton, wool, worsted, silk and rayon, and recently a patented tension for the weaving of worsteds, silks, and rayon was put on the market by the company and has proved to be an outstanding feature in helping the mills to produce the best grade of cloth.

Heddle frames are made for all kinds of looms, varying in length from sixteen inches up to 540 inches. A new reinforced frame for woolen, worsted and plush looms is the company's latest development in this line and is designed to give twice the service of other type frames.

The officers of the company are Walter C. Watson, president and treasurer; Wilbur L. Watson, assistant treasurer; Clifton E. Watson, vice president and general and sales manager; Philip L. Spencer, superintendent; Hubert J. Watson, assistant manager.

THE MILLBURY STEEL FOUNDRY COMPANY

Under the presidency of William W. Brierly, the long-established Millbury Steel Foundry Company has become a leading industry of the town.

In 1917 a two-ton Heroult electric furnace, one of the first to be installed in New England, for the melting of steel for foundry purposes, was added to the equipment, and today fifty hands are employed.

Incorporated in 1908, with capital of \$100,000 it manufactures electric steel castings up to 500 pounds in weight.

Careful moulding, thorough annealing and cleaning enable the concern to fabricate steel castings that are easily machined, and well served by the Boston & Albany and New York, New Haven & Hartford Railroads, as well as by trolley freight, the company has gained a wide clientele.

William W. Brierly is president; W. F. Chase, secretary; F. W. Moore, treasurer, and Robert C. Travers, assistant treasurer, of the concern, which employs 100 hands.

In 1913, W. W. Windle & Company was incorporated, and has capital of \$200,000. Engaged in the scouring and carbonizing of wool and waste are thirty operatives.

W. W. Windle is president and treasurer, and John R. Greenwood, superintendent.

Three years later A. D. Windle & Company was established, for the carbonizing and scouring of wool, and the concern was incorporated in 1924, with capital of \$50,000. A. D. Windle is treasurer, and L. Kunin, president.

In 1920 the Millbury Spinning Company was incorporated with capital of \$100,000 and is engaged in the manufacture of men's wear worsteds, and woolen, cotton, and worsted yarns. The concern employs fifty operatives and the plant has forty narrow looms and 1,296 spindles. Charles B. Rockwell, Jr., is president; Jane W. Root, vice president, and Charles A. Root, of Uxbridge, treasurer.

The Nortex Manufacturing Company was incorporated in 1926, with F. R. Sawyer as president, and H. W. Geib as treasurer, and produces linen toweling and artificial crashes. The plant is equipped with twenty-eight cards, 154 narrow looms, complete bleaching and finishing departments, two boilers, and two water-wheels, and employs 125 operatives.

THE FELTERS COMPANY, INC.

Not until 1910 did Millbury become a felt town. In that year, Herbert L. Bowden, of Boston selected the municipality as a desirable location for the Bowden Felting Company, and the plant bought at that time became the nucleus of what is today the large and important Felters Company, with mills in Millbury, in this state, and in Johnson City and Middleville, N. Y. From the C. D. Morse Sash & Blind factory, where the Millbury unit began business, less than twenty years ago, has grown a modern plant, which includes finishing and hardening rooms, dye house, boiler house, etc.

Herbert L. Bowden foresaw the importance of felt in modern, everyday life, and lived to see the commodity adorn milady's shingle bob; to make up the slippers which encase her dainty feet as well as the spats her husband wears; to produce the tappers on the piano, the multi-colored pennants observed on every hand; to provide the insulation of radio broadcasting studios; the lining of sailors' sleeping quarters on naval submarines and destroyers; to make the sleeping bags of world explorers; to become the linings of fuselage in certain makes of aircraft; to be applied to the channels of automobiles and to be utilized in the padding of shoulders of men's suits.

The Millbury plant gives steady employment to upwards of two hundred hands and is one of the principal industrial mainstays of the town. Upon the death of the founder of the Felters Company, in 1926, William C. King was president and he was reelected president and general manager and has remained in those responsible positions ever since. Frederick S. Peck is vice president; John W. Kilgour is secretary and treasurer.

The continued prosperity of the felt mills and the increasing amount of the output is due in a great measure to President King's efficient management.

Herbert L. Bowden, who foresaw the importance of the felt industry, was a man of varied interests. Aside from his attention to the felt business, he was widely known in the automobile racing field, having established the first auto racing record at Daytona and for a long time it was thought that his speed figures would stand as the permanent record. It was told of him that he took a four-cylinder Mercedes and added another four-cylinder motor to it, thus producing the first eight-cylinder auto racer in the world. It was with his home-made machine that he hung up the world auto speed record at Daytona.

The general offices of the Felters Company are at 99 Bedford Street, Boston.

THE MILLBURY WOOLEN COMPANY

In June, 1927, Hon. Walter E. Schuster and William T. Hayward, both of Douglas, owners of the Hayward and Schuster Woolen Company's mills in that town, purchased at auction the large modern plant of the Cordis Mills, a former Bliss, Fabyan & Co. unit, devoted to cotton production, and began the installation of woolen equipment.

They formed the Millbury Woolen Company with capital of \$600,000 and the following January opened the plant and began the manufacture of woolen suitings and overcoatings. The equipment includes six sets of cards, sixty modern broad looms, 2,362 spindles, dyeing and finishing departments, two boilers and a water-wheel, and 150 operatives were employed at the outset.

William L. Hayward is president, and Hon. Walter E. Schuster, treasurer of the new corporation.

SOME OF MILLBURY ENTERPRISES

The Ramshorn Mill, owned by Charles F. Day, is engaged in carrying on wool scouring operations, and employs twenty-five operatives.

Millbury's industrial operations are not, however, exclusively in the textile fields, despite her prominence along that line.

The town has a fairly wide diversification of manufactures. One of the oldest local industries is Buck Brothers, now owned by William L. Proctor, where fifty skilled mechanics are employed in the manufacture of high-grade edge tools, the reputation for quality products built up generations ago being maintained by the present proprietor.

The Richard French Iron Works, with capital of \$57,500 are engaged in the fabrication of structural steel and ornamental iron work. Raymond Tracey is president, and Alexander B. Campbell, is treasurer.

The Home Soap Company whose main office is at 103 Webster Street, Worcester, operates its factory, at Millbury Junction, where inedible tallow, meat and bone scraps are produced. The corporation has capital

of \$40,000. E. R. Avery is president, and F. M. Holmes, treasurer and secretary.

The Lynch Spindle Works, owned by Peter Lynch, manufactures shuttle irons. The corporation has capital of \$15,000.

The Rice Dobby Chain Company, owned by Warren B. Harris, produces dobbie chains, and Benjamin O. Paine is engaged in the manufacture of edge tools.

THE NEW ENGLAND HIGH CARBON WIRE COMPANY

The fastest growing local industrial enterprise is the New England High Carbon Wire Company.

Starting operations about seven years ago in the old Stoddard Rubber Company works, the company has made material plant extensions year after year, and in 1927 erected a building 160 by 60 feet upon land formerly owned by the Richard French Iron Works, whose plant it also purchased.

The corporation has capital of \$300,000 and employs upwards of one hundred operatives in the manufacture of high carbon wires. Carl T. Lund is president; Alfred J. Jacobson, secretary, and Frank Kilmer, treasurer. The latter official was formerly connected with the Wickwire-Spencer Steel Corporation, where he occupied a high executive position.

THE MANUFACTURES OF MILLVILLE

Millville, the youngest town in Worcester County, was set off from Blackstone, in 1916, and has two units of the United States Rubber Company—the Lawrence Felt Company, a subsidiary of the Revere Rubber Company, of Chelsea, manufacturing felt, and employing 150 hands, and the Woonsocket Rubber Company producing rubber boots and shoes, and capitalized for \$1,500,000, employing 2,000 operatives. The plant occupied by the latter concern was erected in 1882, at a cost of \$750,000.

In 1920, the Lamb Knitting Company was incorporated with capital of \$25,000, and is engaged in the manufacture of woolen and worsted and light-weight knitted fabrics. L. A. Almon is president, and J. A. Mulvey is treasurer.

NORTHBORO'S INDUSTRIES

About 1793 iron works, located on the Assabet River, and a manufactory of edge tools, were in operation, in Northboro.

In 1814 the Northboro Manufacturing Company built a \$30,000 factory, which turned out 387,000 yards of cotton cloth yearly. In 1860 it was burned, and a new plant was erected six years later where Daniel Wood manufactured woolen blankets.

In 1837, Northboro had two cotton mills, with 1,820 spindles and that year 220,000 yards of cotton goods were manufactured, valued at \$30,400, while the local boot and shoe factories of the period produced 7,255 pairs of boots and 20,800 pairs of shoes, valued at \$30,720, and employed seventy-five workers. The production of horn combs was begun in 1839 by Haynes & Bush, and in 1860, Milo Hildreth engaged in the manufacture of tortoise shell jewelry.

In 1921, the H. W. Gorin Company was incorporated, with capital of \$30,000, to manufacture wool shoddy. H. P. Gorin is president, and H. W. Gorin, treasurer of the corporation.

The plant formerly occupied by the Northboro Woolen Mills was purchased on October 7, 1927, by Sherman L. Whipple, Jr., president and general manager of the Chilton Company, of Webster, and the production of woollens was begun. Approximately one hundred operatives are employed.

L. F. Proctor owns and operates the Boston Woven Wire Brush Company and produces woven wire dynamo brushes.

The Robert Whittaker Company is engaged in the manufacture of shoddy.

THE INFLUENCE OF WHITIN FAMILY ON THE TEXTILE INDUSTRY

The village of Whitinsville serves as a typical example of an industrial community that owes its prowess to the activity of successive generations of a family whose name the locality bears. It dates its manufacturing life to Colonel Paul Whitin, of Revolutionary fame, who began his apprenticeship as a blacksmith in the town of Northbridge, prior to the beginning of the nineteenth century.

As early as 1727, Samuel Terry established an iron forge, at Mumford Falls, and in 1736, the works included three fireplaces, one hammer and an ore yard.

The year 1931 will mark the centennial of the founding of the Whitin Machine Works, which, in 1834, found itself quartered in an humble ell, 20 by 40 feet, of the old Paul Whitin & Sons cotton mill, a concern that then boasted 1,500 spindles. On July 30, 1832, its founder, John C. Whitin, son of Paul Whitin, patented his machine for spreading and picking cotton. The invention followed four years after John Thorp, of Providence, R. I., had perfected his ring spinning device, and the Whitin Machine Works were one of the first concerns in the United States to manufacture ring spinning frames.

John C. Whitin's first picking machine was marketed in 1834, and, by 1847, the demand for the device was so great that a shop was erected for the manufacture of machinery.

Paul Whitin had begun business in a country blacksmith shop which was developed, through the manufacture of scythes and hoes into the establishment, in 1809, of a cotton mill—the third located in the Blackstone Valley, north of Pawtucket, R. I. The firm of Paul Whitin & Sons carried on the machine building operations, with the cotton production, until 1864, when the firm was dissolved, and John C. Whitin took over the former business, while his brothers assumed the management of the cotton mills. Until 1870 Mr. Whitin did business in his own name, and in that year the Whitin Machine Works were incorporated, with John C. Whitin, as president; Josiah Lasell, as treasurer, and Gustavus E. Taft as superintendent. Previous to that date, a foundry had been added to the plant with a smelting capacity of two tons. Today more than 150 tons of pig iron are melted daily at the plant, and modern machinery has replaced the hand work of former times. The present plant requires 4,500 tons of steel each year; 4,000,000 feet of lumber annually, and 20,000 tons of coal for power.

It has been a story of expansion ever since that time, for the Whitin Machine Works were not three years old before orders came in such volume as to make it desirable to erect the first shop. While for the first fifteen years or more the concern produced general textile machinery of

many types, in 1847 it was decided to establish a definite policy and manufacture only cotton machinery.

The concern has grown from a small machine shop, large enough to build one picker a month to a plant covering about forty-five acres, equipped to turn out enough machinery, when necessary, to fill a 12,000 spindle mill every week.

THE OX TEAM SUPERSEDED BY THE FREIGHT CAR AND AUTO TRUCK

In the early days the company delivered its machinery in ox teams to the New England mills it served. It was a long and tedious procedure from the time of placing the order to the date of actual delivery. How different it is today, where, instead of small New England deliveries the company ships its products to all parts of the world, including Canada, Mexico, Spain, Italy, France, Germany, Russia, India, China, Japan and South America as well as all over the United States.

Between 1870 and 1880 Henry F. Woodmancy, who had charge of the manufacture of spindles for the frames, invented a new device called the Whitin Gravity Spindle, assigning the patent to the Whitin Machine Works. This invention was contemporaneous with the introduction of the Sawyer and Rabbeth spindles, and it played an important role in making possible the present high spindle speeds.

The management of the concern has been in the hands of the one family since the inception of the company. The employees really form a town-ship, and community spirit runs high in Whitinsville.

The Whitin Machine Works has its own water works and fire department, both of which are supplied to the town free of charge.

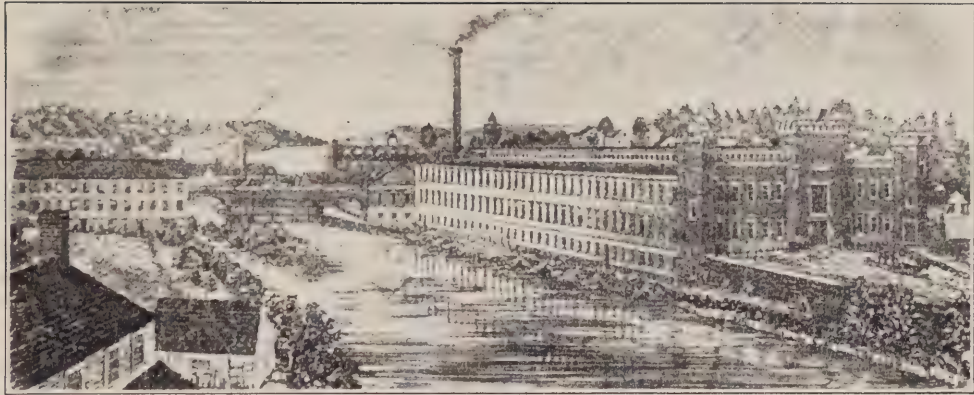
Four thousand persons find employment in the works in normal periods, and the company has been foremost in providing homes for many of its workers, the housing development undertaken some years ago which includes over 1,000 tenements, being as extensive as that of any New England concern. A community house, with gymnasium, swimming pool, billiard room, bowling alleys, shooting gallery, is provided among many other facilities.

Labor overturn at the Whitin Machine Works has never been the serious problem it is in some industries. Twenty-five employees of the concern have continuous service records of fifty or more years; thirty-seven, of from forty to fifty years; 123, from thirty to forty years; seventy-six, of from twenty-five to thirty; 108, of from twenty to twenty-five; 204, of from fifteen to twenty; 226, of from ten to fifteen, and 466, of from five to ten years. The company's boarding houses, with rooming capacity of over five hundred men, have played a large part in finding homes for unmarried employees and in stabilizing the working force.

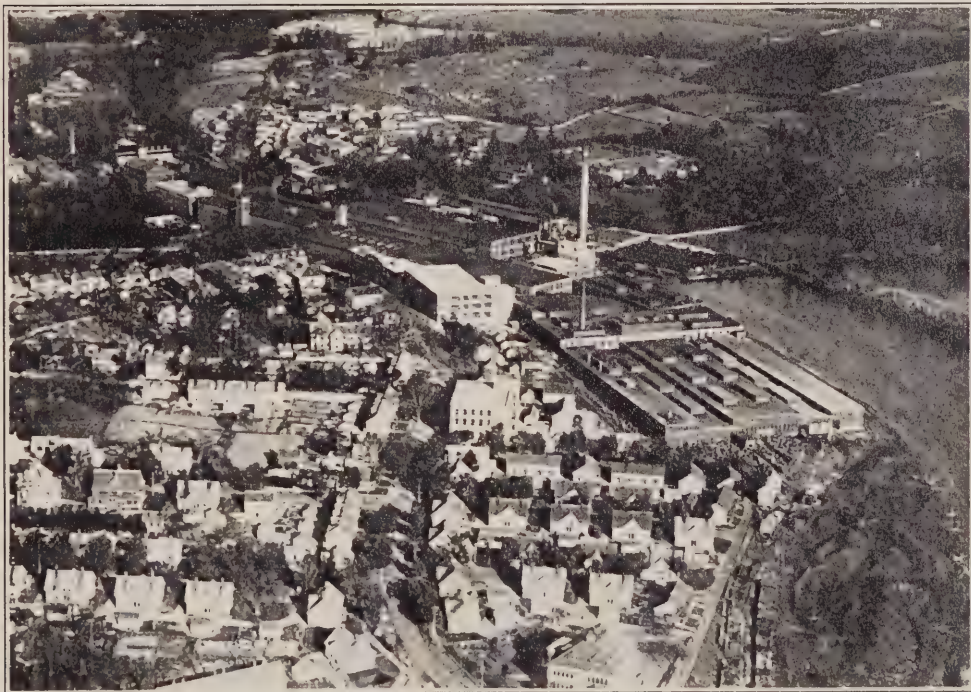
In 1927 the business of the Cashiko Machine Company of Worcester was bought by the Whitin Machine Works, and the equipment was removed from Worcester and installed in the Whitinsville plant. The Worcester unit manufactured condensers and cards for woolen mills, and employed about 200 operatives.

The products of the Whitin Machine Works cover all the ramifications of the cotton, cotton waste, silk, woolen, and worsted fields, and it is not difficult for the concern to set up a complete mill.

In the cotton industry it provides machinery for cleaning, opening, conveying, distributing and picking cotton, revolving flat cards, sliver



WHITIN MACHINE WORKS, WHITINSVILLE, ABOUT 1850



WHITIN MACHINE WORKS, WHITINSVILLE, 1928

lap, ribbon lap and combing machines, drawing, roving and spinning frames, spoolers, twistors, reels, quillers, loom dobbies, and filling winders. Its cotton waste machinery devices, applicable to woolen systems as well, include openers, pickers, willows, card feeds, full roller cards, condensers, revolving flat cards, derby doublers, hard waste machines, roving and spinning frames, and spoolers and twistors.

In the silk production field it manufactures ring twistors and winders, and in the woolen machinery line it produces card feeds, full roller cards, wool spinning frames, and condensers.

For worsted plants it supplies cone roving frames, ring twistors and a cap spinning on the Bradford system, and in the field of supplies it manufactures rings, hank clocks, Magrath clutches, spindles, roll spreaders, rolls, flyers, and bunch builders.

The corporation has capital of \$9,000,000, and employs upwards of 4,000 hands. Branch plants are operated at Charlotte, N. C., and Atlanta, Ga., to take care of the needs of Southern textile concerns. C. W. Lasell is president, Sidney R. Mason, secretary, E. Kent Swift, treasurer and general manager, W. H. Hoch, assistant treasurer, and L. M. Keeler, agent.

THE INVENTIONS OF ARTHUR F. WHITIN AND CHARLES E. TROWBRIDGE

Fifty-seven years ago last January there was formed the Whitinsville Spinning Ring Company, now the largest plant in the world devoted exclusively to the manufacture of spinning and twister rings for cotton, wool, silk, asbestos or jute.

In 1872 Charles E. Trowbridge, master mechanic of the Whitinsville Cotton Mills, and Arthur F. Whitin, the youngest son of the owner, then employed in the repair shop of the mill, invented and patented special tools for making rings. They began manufacturing in January, 1873, in the mill repair shop under the firm name of the Whitinsville Spinning Ring Company.

The company originally began the manufacture of rings for the local and vicinity cotton mills, but its fame soon spread and the demands for increased production required frequent extensions. Material additions to the plant were made in 1882, 1887, 1891, 1896, 1905 and 1920.

In 1887 George E. Trowbridge was admitted to the firm and continued in active charge of the manufacturing operations until his death in 1920.

Arthur F. Whitin was president and treasurer up to his death in 1927. C. F. Trowbridge is president, and Stuart F. Brown, is vice president, clerk and treasurer. The concern employs seventy-five operatives and has capital of \$200,000.

The Rockdale Mill of the Paul Whitin Manufacturing Company which was established in 1809 and incorporated in 1916, is capitalized for \$1,200,000, and is equipped with 64,000 cotton spindles and 1,728 silk spindles, 300 jacquard, 1,600 plain and dobby and 100 box looms, five boilers and three water-wheels, and employs 900 hands in the manufacture of combed cotton, cotton and silk and silk cloths, and combed yarns.

Henry T. Whitin is president; Richard C. Whitin, clerk, and Paul Whitin, treasurer.

The Linwood Mill, owned by Whitin Brothers, Inc., was established in 1866, and incorporated in 1919, and is capitalized for \$600,000. It has fifty-six cards, 22,284 ring, 6,816 mule, and 300 twist spindles, eight-

een cotton combs, four boilers, two water wheels and 700 looms, and produces fine shirtings, cambrics, voiles, and lawns employing 375 hands. Earl J. Liberty is president and treasurer, Samuel Lynn, clerk, and E. L. Richards, superintendent.

The Kupfer Brothers Company paper plant at Riverdale, where surface-coated papers are turned out, is located at a point where James Nutting first improved the available water-power, in 1764, and where also Dunn Brothers established a cloth mill in 1817.

The concern has capital of \$400,000 and employs 150 operatives.

Berthold Kaufmann is president and H. G. Wocel is treasurer.

As early as 1875 the capital locally invested in the manufacture of machinery was \$605,000, the annual output was valued at \$900,000, while the total investment in cotton and textile machinery plants at that period was approximately \$900,000, and the value of the products manufactured exceeded \$1,000,000.

THE MANUFACTURES OF NORTH BROOKFIELD AND OAKHAM

From 1810 until the panic of 1837 North Brookfield's leading industrial enterprise was the Oliver Ward shoe factory, which afforded employment to several hundred men and women. In 1819, Tyler and Ezra Batcheller began shoe production there, and by 1828 the footwear concerns were turning out products valued at approximately \$500,000 a year. Twenty years later the Batcheller enterprise gave employment to nearly 1,000 operatives. In 1886 the E. & A. H. Batcheller Company was employing 1,300 workers, doing business of \$3,000,000 a year, and occupied three acres of manufacturing space.

In 1886 John A. White began the manufacture of overalls, the business having been started some years before by a North Brookfield woman who sold it to Edward S. Chesley, and he, in turn, disposed of it to Mr. White.

The present day partnership of John A. White & Co., is made up of Messrs. John A. and John W. White, and seventy-five operatives are employed.

In 1906 T. G. Richards organized the B. & R. Rubber Company, and ten years later the concern was reorganized as the Quabaug Rubber Company when H. T. Mason became its treasurer. Today it is capitalized for \$250,000, employs 350 hands and is North Brookfield's largest industry, being engaged in the production of mechanical rubber goods, and rubber soles and heels, turning out daily five tons of corrugated mats and three tons of baby carriage tires besides the other commodities.

H. T. Mason is president and treasurer, and Frank Smith, secretary of the corporation.

The Asbestos Textile Company was established in 1915, and was incorporated five years later, with capital of \$1,100,000. It is engaged in the manufacture of asbestos textiles, employing 250 operatives, and has its general offices at 475 Fifth Avenue, New York City. Arnold W. Koehler is president, Arnold W. Koehler, Jr., treasurer; A. S. Pratt, vice president; D. G. Maxwell, secretary, and H. Y. Stelljes, assistant treasurer of the corporation.

The shoe plant of the H. H. Brown Company was acquired by Ray W. Heffernan, of Spencer, formerly with the Allen-Squire Company; D. J. Danahy, of Natick, and M. H. Barry, of Marlboro, in November,

1927, and a new corporation was formed, with Mr. Heffernan as president; Mr. Danahy, as treasurer, and Mr. Barry, as superintendent, and the manufacture of shoes was resumed. The corporation has capital of \$144,100 and employs 300 operatives.

The Arthur Jackson Willis Company, owned by H. E. Willis, is engaged in the manufacture of rubber machinery.

In 1857 Lewis Dean began the manufacture of wire goods in Oakham, later removing to Worcester.

In the '90s the town was widely and favorably known as the seat of S. M. Sargeant's factory for the production of flavoring extracts, essences and perfumes.

OXFORD—A BUSY INDUSTRIAL TOWN

The town of Oxford is the center of a number of textile enterprises in both the cotton and woolen fields, the plants operating upon the excellent water privileges which run from North Oxford, to the Webster town line.

In 1880 the late Edwin Bartlett established the Edwin Bartlett Company, the concern becoming incorporated in 1903, with capital of \$65,000.

The plant is equipped with 8,000 spindles, nineteen cards, three boilers, and two water-wheels, and 100 operatives are employed in the production of cotton warps and yarns.

Edwin N. Bartlett, son of the founder, is president and treasurer, H. B. Hallowell, secretary, and W. E. Thayer, superintendent.

In 1883 Reuben Comins, of Troy, N. Y., bought the Shaw Mill, and erected a picker house and store houses. The plant was sold that year, following the death of Mr. Comins and it was bought by Edward S. Comins and the next year was leased to his son, Irving E. Comins and John D. Clark, and was operated as Comins & Co. Five years later E. I. Comins purchased the Clark interest, and in 1895, a weave room and finishing department were built. In 1905 the company was incorporated, and in 1914 Edward I. Comins II entered the business. In 1904 the finishing room was enlarged by an addition half as large as the original structure, while the following year the weave room was increased seventy-five per cent. In 1926 an additional set of machinery was installed, giving the concern four sets of woolen equipment, one hundred of the new looms being of the automatic type. Altogether the plant has 1,344 woolen spindles, two pickers, a boiler and two water-wheels, as well as complete weaving, dyeing and finishing units. The present officers are Irving E. Comins, president and manager; Arthur C. Comins, treasurer; Edward I. Comins, assistant manager and clerk.

The corporation has capital of \$50,000, and employs seventy-five operatives in the manufacture of cotton warp woolens.

Andrew Howarth & Son, one of the oldest textile units in the town, operates the Oxford Woolen Mill in Howarth Village, in the manufacture of white flannels and all-wool colored blankets, and employs seventy-five hands. The plant has four sets of cards, fifty broad looms, a picker, 2,400 spindles, complete bleaching and finishing units, one boiler and one water-wheel.

A. P. Howarth is now the sole owner.

David N. Taft employs 125 operatives at the Bernon Mill, in Oxford Center, where cotton warp woolens are produced. The plant has six sets

of cards, ninety-four narrow looms, 1,776 woolen spindles, dyeing and finishing departments, one boiler and one water-wheel.

Mr. Taft also owns and operates the Lamb Mill, where shoddy is produced, the plant having five pickers.

A. F. Putnam, doing business as Putnam Brothers, maintains the headquarters of his wooden box business, in Oxford, and operates a plant, in Charlton, where twenty-five operatives are employed.

William W. Taft, Jr., and Alfred M. Taft, operating as Taft Brothers, manufacture portable garages, and employ twenty-five hands.

The Thayer Woolen Company was incorporated in 1893, with capital of \$240,000, and manufactures overcoatings, cloakings and unions, employing 300 operatives at its North Oxford plant.

The company operates thirteen sets of cards, 220 narrow looms, 3,888 spindles, complete dyeing and finishing departments, and has two boilers and three water-wheels. George W. Norwood is treasurer and secretary, and Walter S. Pomeroy, president of the corporation.

In 1924 James Whittaker & Sons, Inc., was incorporated, with capital of \$300,000, with James Whittaker as president and treasurer. The garnetting, stripping and sorting of woolen and worsted waste, tussah, and artificial silk constitute the company's activities. The plant has eight sets of cards, twelve garnets, ten pickers, one boiler and a water-wheel. James Whittaker is president and treasurer, and Stanley Whittaker, secretary. Thirty hands are employed.

The Ivanhoe Blanket Company, owned by J. E. and J. F. McWilliam, manufactures camping blankets and carries on the custom carding and spinning of woolen yarns. The plant is equipped with three sets of cards, and thirty broad looms.

The Oxford Woolen Company was incorporated in 1927 with capital of \$100,000 and acquired the plant of the Scarboro Woolen Mill Company, where it manufactures shirtings, suitings, and coatings, employing seventy-five operatives. The factory has five sets of cards, twenty broad looms, 1,000 woolen spindles, complete dyeing and finishing units, one boiler and one water-wheel.

C. S. Taylor is president and secretary, and Samuel Miller, treasurer, of the corporation.

THE CHAFFEE BROTHERS COMPANY

Oxford has many industries whose manufactured goods here and overseas, have done much to bring the name of the community to the attention of the world, yet it is probably safe to venture that a single department of the sizable plant of the Chaffee Brothers Company turns out a product in thousand lots daily that is carrying regularly the name of Oxford to more trade centers of this country and abroad than any other single commodity manufactured within the limits of the township.

The Chaffee patented cloth boards for winding silks, woolens, cottons, felt and knit goods, a product whose sales are today well up in the millions annually, and whose users comprise textile manufacturers from Maine on the north, North Carolina on the south, to Utah on the west, and to Bradford, England, on the east, all of whom find these boards greatly to their advantage.

While this product is but one of several, with lumber as a base, either manufactured or handled by this corporation, it is the one which has the

most promising future. Here is a commodity that has not only made good in a great way, but one which is causing such a demand month by month that it is only a question of a few years at the most before the corporation will have to provide facilities to at least treble the output of today.

Thirty-six years ago Alfred M. and Herbert V. Chaffee, equipped with ten years' practical experience as contractors in handling standing timber and lumber, recognized an opportunity in their joint plant to establish a box factory and lumber yard, centrally located in Oxford. Financial assistance was forthcoming, and in 1893 two acres of land, a part of the Dr. Holman farm abutting on the railroad in Oxford Centre, was purchased. Here was erected a small factory, and a siding was installed, whose total capacity was limited to four freight cars.

During the first year the brothers in their small plant handled some 200,000 square feet of lumber, the bulk of which came from their own timber land, and the greater part of which went out in the form of shipping cases.

From this small beginning, back in 1893, there has developed an industry that today covers ten acres of ground in factory buildings and lumber yards, with a capacity of handling and shipping in the form of boxes, frames for winding boards and dressed lumber, more than 10,000,000 feet of lumber annually. Where the early plant of 1893 had a four-car siding, the concern today is fed by sidings whose capacities are rated at thirty-one cars.

It would only be natural to infer that the manufacturing end in itself was of sufficient size to command the undivided attention of the Chaffee Brothers. But almost the reverse is true, for there has been developed on a large scale a retail department, including wood, coal and ice, dressed lumber, all the necessities that go with a frame building, until the concern provides every supply needed to construct and finish a dwelling from the cellar to the gables, including wall paper, paint, glass, nails, etc. This ability has been demonstrated on several occasions, when customers contracted for the lumber, hardware and finish of a cottage to be delivered in one lot in other towns and cities.

The concern has maintained portable sawmills and crews at work in the timber lands, a department in itself which requires equal attention with the factory end. Beginning in 1893 with a dozen men and one mill, the company today has two hundred woodsmen with the operatives in the factory, who are cutting timber lands and stumpage owned by the corporation throughout the New England states.

The clothboard department was established twenty-eight years ago, when the brothers were granted patents on their invention and it is rapidly becoming the most important part of the business.

In 1922 a modern band sawmill was installed, which provides a most excellent market for logs growing within the practical truck hauling distance of any lot within twenty-five miles of the plant.

In 1921 the box factory was enlarged and reconstructed of brick, making it 104 feet wide by 150 feet long and three stories high, with a three-story shipping room 35 by 70 feet.

The enterprise was incorporated as the Chaffee Brothers Company in 1900, with capitalization of \$30,000. In 1903 this was increased to \$90,000, and is all paid in. On June 30, 1921, it was again increased to \$180,000 and on September 28, 1922 to \$350,000. Another increase raised it

to \$450,000. A. M. Chaffee is president and treasurer, with Joseph L. Brown and Ira G. Ellis, assistant treasurer, who, with J. C. F. Wheelock, A. B. Chaffee, L. J. Chaffee and R. B. Chaffee constitute the board of directors.

The concern is by all odds Oxford's fastest growing industrial enterprise.

The C. A. Grosvenor Shoe Company of Worcester, operates one of its plants in Oxford. The Oxford Woolen Mills employ seventy-five hands in the production of white flannels, and the White Village Mill, located at North Oxford, owned by E. S. Boteler and J. W. Bruyn, employs thirty hands in the manufacture of cotton checks and plaids.

ROYALSTON, SHREWSBURY AND SOUTHBORO INDUSTRIES

In the earlier days Royalston had six small tanneries, two brickyards, two potash factories, and in 1780 and even later palm leaf hat and Shaker bonnet manufactories, but the principal industrial activities have long been confined to the village of South Royalston, where, in 1813, the Royalston Cotton & Wool Manufacturing Company's plant was built. Destroyed by fire in 1833, it was rebuilt and the stone mill, which was erected on the site, was burned in 1892. A new plant was soon built and in 1908 it was taken over by the American Woolen Company and soon after enlarged. The plant was equipped with ten sets of cards; eighty-two broad looms, 2,976 woolen spindles, a dyeing department, two boilers and three water-wheels, when it was sold in 1929 to the Mason & Parker Manufacturing Company of Winchendon, which concern is now carrying on the manufacture of wooden toys at this unit, as well as in Winchendon.

Many years ago chair manufacturing was carried on to a limited extent in Royalston.

In 1809 Luther Goddard set up a factory for the manufacture of watches, in Shrewsbury, and with the assistance of some rather primitive machines, and a few skilled Swiss and English watchmakers he produced on an average nearly one hundred timepieces a year. He had scarcely scratched the surface when the removal of the tariff restriction in 1815 took place, and he found himself unable to meet the competition of the European watchmakers, due to the heavy importation of foreign watches.

In these days when sales conferences are in vogue in many large industries, it is interesting to observe how Goddard overcame the sales resistance that existed when he began operations, nearly a century and a quarter ago.

Perhaps he had taken a leaf out of the book of experience written by Eli Terry, of Connecticut, who after carving his clocks out of wood, journeyed about the countryside, seeking to market his products.

Approaching a prospective customer who seemed to be indifferent toward a timepiece, Terry would request permission to leave a clock in the house while he journeyed on with the others he carried in his wagon, and frequently upon his return several days or weeks later he would find that the members of the household had become so accustomed to regulating their goings and comings by the clock that the original sales resistance had been worn down, and they immediately completed the purchase.

Goddard followed much the same practice, by inventing the pretext

that he would leave one of his watches until he came back on his return trip, simply asking that the person to whom he had loaned it should keep it wound and should report to him when the next appeared whether it seemed to keep good time. By adopting this course he was able to market all the pocket watches he and his assistants could produce.

Although not pretending to be the center of industrial pursuits, Southboro at various times housed six grist mills, three sawmills, a small wire factory, a carpet mill, a flour mill, two sash and blind factories, a peg mill, three tanneries, a currier shop, a brush factory, two brick kilns, three cotton and woolen mills, six boot and shoe factories, a bonnet plant, and a carriage factory.

Beginning in 1845 extensive boot and shoe factories were built at Southville by John Hartt & Co., Messrs. Newton and Hartt and G. Bickford Brigham, the latter employing 100 hands, and turning out products valued at \$165,000 as late as 1890.

William B. Wood built a cotton and woolen goods factory, at Southville, and in 1846-47 Milton H. Sanford erected a stone mill, in Cordaville, where he manufactured cotton and woolen goods. The plant was burned October 31, 1855, but was rebuilt, and in 1864 the Cordaville Mills Company bought the property. Five years later it was purchased by Adolphus Merriam, of Framingham, and in 1876, the Cordaville Woolen Company became the owner, and operated it until 1926, in the manufacture of woolen blankets. The mills include two large factories of stone and brick, one four stories and the other three stories in height, two storehouses, and an office building and power plant, and here the manufacture of various types of woolen fabrics was carried on from the inception of the mills until 1926. The plant operated day and night during the Civil War in producing woolen blankets for the United States Army. In 1928 the property was purchased by Bernie Cotton, of Worcester, who operates it today as a shoddy mill.

In 1872 the village of Fayville was the seat of the Curtis Shoe Company and the Whiting family established there one of the first brush factories operated in New England.

The famous Deerfoot Farms Company is today the largest local industry, employing 125 hands in producing dairy and pork products. It is owned by Robert M. Burnett and is managed by James E. O'Leary.

SOUTHBRIDGE—HOME OF THE WORLD'S LARGEST OPTICAL COMPANY

While Southbridge does not claim to have been the place in America where the first spectacles were manufactured, it does assert, with some degree of firmness, backed by facts, that it is the home of the oldest optical company in this country, and probably in the world.

In 1833 it will celebrate the one hundredth anniversary of its founding by William Beecher, a native of Southbury, Conn., who learned the jeweler's trade, in Providence, R. I., and removed to Southbridge, in 1826, where he opened a jeweler's shop, where now stands the Hartwell drug store.

Beginning in 1833 Beecher occupied the second floor of the building, in the manufacture of silver spectacles; invented tools and devices to aid him in production, and so increased his business that in 1839 he re-



WHERE THE AMERICAN OPTICAL COMPANY WAS BORN IN 1839



THE AMERICAN OPTICAL COMPANY, SOUTHBRIDGE

moved to a wooden building located on the site of the plant today occupied by the Hyde Manufacturing Company, and which was the nucleus of the present-day plant of the American Optical Company. In his new shop Beecher carried on experiments with spectacles made from steel, using a pair of English products as a guide, and prior to 1843 he manufactured "undoubtedly the first steel spectacles made in America."

In 1840 Beecher sold the business he had started to Messrs. Ammidown & Putney, but apparently remained in their employ, as it appears that he "was hired by Mr. Ammidown for one year to teach his son."

From 1842 to 1849 the firm was known as Ammidown & Son, and consisted of L. H. Ammidown, a man named Holdridge, who, apparently withdrew in 1850, when Mr. Ammidown and Robert H. Cole were listed as partners. The following year Beecher bought an interest, and in 1853, when L. H. Ammidown died, the firm name was continued for eight years, being changed to Beecher & Cole in 1860, when E. Merritt Cole purchased an interest. Two years later Mr. Beecher retired, and the Messrs. Cole continued as partners, under the firm name of Robert H. Cole & Co., admitting A. M. Cheney to the group in 1866.

It was at the beginning of the second half of the nineteenth century that the Wells family, whose influence has been the dominating factor in the development of this, the world's greatest optical enterprise, first became identified with its activities.

In 1851 Hiram E. Wells entered the Ammidown plant, as an apprentice, at the munificent wage of \$30 per year, with board, during the first twelve months. He was one of a dozen employees. At that period the stock was rolled by hand, and each bench worker manufactured spectacles "by the piece."

In 1852 there were produced at the Beecher factory, 14,919 pairs of spectacles, of which total 11,300 were of silver mounting.

THE INFLUENCE OF GEORGE W. WELLS

The second day of April, 1864, stands out prominently in the annals of the optical industry of America, for it marks the date of the advent of George W. Wells, whose influence in the Southbridge company was potent and dominating for more than forty years thereafter.

He was one of the first to begin the making of complete pairs of spectacles without first serving three years or more as an apprentice. In 1865 he was sufficiently proficient in the art as to enable him to earn \$2 per day, although his first month's work netted him but \$15.

He entered the concern when the methods of producing spectacles were in a transitional stage, and he was an important factor in effecting many changes that were then being made in the methods of manufacture. When he entered the shop the hand system was changing to partial die and machine work, and as no machine tools then existed in the factory, he made use of the mechanical equipment at the plant of the Hamilton Woolen Company, in Southbridge.

Of an inventive turn of mind he early saw that various mechanical devices must be produced if the cost of production was to be lessened, and he designed and invented the eccentric rolls—the first application of the principle in tapering stock for spectacle temples. He next built the first lens cutting machine, which, with slight modifications, is now in use in practically every optical plant throughout the world. He next



THE LENSDALE PLANT OF THE AMERICAN OPTICAL
COMPANY, SOUTHBRIDGE



ADMINISTRATION BUILDING AND MAIN PLANT OF THE AMERICAN
OPTICAL COMPANY, SOUTHBRIDGE

produced a machine for peening or knocking on end pieces, a device now in universal use in the spectacle world. He invented a device for jumping and focusing spectacles and his contributions did much to firmly establish the Southbridge "spec shop" in the optical industry.

By 1868 largely as the result of Mr. Wells' inventions, the Cole factory was employing thirty-five hands, and that year its sales were \$50,400.

In January, 1869, having decided to become an independent optical manufacturer, he retired as an employee of the Cole factory, and went to New York and New Jersey inspecting available sites for a plant, but reaching the conclusion that Southbridge was as advantageous a town as any for the enterprise, he returned home, and, with his brother, Hiram C., acquired a controlling interest in the H. C. Ammidown shop, which was formerly the E. Edmonds Sons optical plant. He was offered a partnership in the firm of Robert H. Cole & Co., where he had been employed, but he declined to accept the arrangement unless his brother was permitted to join the enterprise. The outcome of his overtures was a merger of the Ammidown and Cole companies, the consolidated group adopting the name by which it has since been known—the American Optical Company. Robert H. Cole was elected president; George W. Wells, clerk; E. Merritt Cole, treasurer, and the Messrs. Cole and Alpha M. Cheney, constituted the first board of directors. Four hundred shares of \$100 each were apportioned as follows: Robert H. Cole, one hundred and fifty shares; E. Merritt Cole, eighty; Alpha M. Cheney, fifty; Hiram C. Wells, fifty; George W. Wells, forty; Charles S. Edmonds, thirty shares. The next year Hiram C. Wells and Mr. Edmonds were added to the directorate, and in 1871, the capitalization was increased to \$60,000. The following year the company purchased land of the Central Mills Company and built a new factory.

In 1879 George W. Wells was chosen treasurer, and until the opening years of the present century was to all intents and purposes a traveling salesman and sales manager. His sons, Albert B., Channing M. and J. Cheney Wells assisted him in this work, during the '90s, and in 1902, the first regular traveling salesman was employed.

In 1882 the Mechanics Mills property, erected by the Central Mills Company, in 1866, was acquired, and was operated as the lens department from 1883 to 1888. In the latter year, the first of the units, known as the Lensdale plant of the company, was built on the site of the Columbian Mill, and from that year to the present extensions have been made every few years.

The early buildings were of wood, but, in 1899, the first unit of brick mill construction was erected, now known as the north front of the Main Works. Thereafter, the reconstruction of the plant was advanced, only brick, concrete and steel being employed, and in 1908 the last of the wooden structures was demolished. The steel reenforced concrete Lensdale building is an example of the latest approved ideas in industrial construction, while the Administration Building is without a rival in Massachusetts.

The industrial social service which has been a primary consideration of the progressive officers of the corporation for a quarter of a century, or more, is strikingly indicated in the library, dining and banquet rooms, cafeteria, and other service rooms for the operatives, located in the Ad-

ministration Building, as well as in the apartments which are maintained for unmarried women workers.

Many of the faithful employees of the corporation have passed all the years of their active lives in its service, and to them the progress of the concern from the dozen employees of the late '30s to the more than 4,500 who are carried on the present payroll has been a factor in which they take great pride.

The American Optical Company maintains four branch plants, one in Worcester, one in Cambridge, and two in Canada.

The administration of its world-wide activities are carried on by three sons of the late George W. Wells. Channing M. Wells is president, J. Cheney Wells, vice president and secretary, and Albert B. Wells, treasurer.

THE HAMILTON WOOLEN COMPANY

As early as 1750 the development of the Globe Village water privilege was undertaken by William Plimpton, who built a dam and fulling and scouring mill, later adding grist and linseed oil mills.

About 1812 James and Perez B. Wolcott formed a company for the manufacture of cotton yarn, took over the water privilege, and two years later reorganized the concern as the Globe Manufacturing Company, erecting a small factory, which was used by the Hamilton Woolen Company until a few years ago, as a carpenter shop, and which, at the time it was erected, was one of the largest cotton mills in the country. In 1816 James Wolcott, Jr., formed another company at Globe Village to manufacture woolen goods.

All the weaving at the Globe plant, which, in 1819, was incorporated as the James Wolcott Woolen Manufacturing Company, with capital of \$140,000, was originally done by hand, but sixteen power looms were installed in 1823, and two years later 45,000 yards of broadcloths and cassimeres were turned out.

It is well authenticated that when the Globe officials proposed the substitution of power for hand looms, the policy was strenuously opposed by the weavers, who feared the loss of their positions.

On January 17, 1831, the Wolcott Company became the Hamilton Woolen Company by an act of incorporation, and in 1836 and 1837 plant extensions were made and 125 operatives were employed. In 1844 a new mill was erected and the manufacture of muslin delaines was inaugurated. Three years later, a printing department was added, which was operated until 1886. In 1860, another mill unit was erected, into which went the first cap spinning frames ever installed in a factory, and in 1873 all mule spinning of worsteds ceased. Between 1907 and 1912 a period of rapid expansion took place and in 1917-18 all the cotton machinery was discarded, plant additions were made and much new equipment added.

A reorganization took place in 1927, and obsolete machinery and equipment not required under the new production schedule was scrapped or sold.

A new dye house was erected in 1928-29, much new equipment installed, and the machinery rearranged for more efficient production, all of the expenditures being met from the proceeds of the sale of machinery and other tangible assets.

The addition of a line of men's wear was accomplished at a reasonably

small expense, and the development of a line of women's wear that was up-to-date and properly styled was undertaken. This program meant, with one exception, the elimination of every fabric formerly made at the plant.

In the process of marketing the new fabrics, the name Hamilton was reestablished in the market. In 1927 the company had 50,000 spindles, 1,200 looms and twenty-seven factory buildings.

That year, the pipe, machine, and carpenter shops, and the electrical department were centralized in one unit, while the building known as the Top Mill, was leased to the Barre Wool Combing Company, of Barre, and seventy-five hands are employed there.

The Hamilton plant operated in 1927 and 1928 on a 48-hour per week basis, with the exception of the weaving department which ran night and day a great deal of the time. Women's dress goods constitutes seventy-five per cent of the volume and men's fabrics the remaining twenty-five per cent and upwards of one thousand hands are employed.

In 1927 a proposition was advanced to liquidate the corporation, which, in 1931, will observe its centennial anniversary. This policy was strongly opposed by a majority of the stockholders, and Richard P. Lennihan was chosen treasurer, and given free rein by the board of directors to revamp the plant and develop a new marketing and production program.

In one short year he succeeded in turning the operating losses of 1925-26 of \$502,783.86, and of 1926-27, of \$302,490.77, into a profit of approximately \$85,000 after all charges including depreciation, interest, reserve, etc.

At the annual meeting on February 6, 1929, the following directors were chosen: Robert Amory, Thomas P. Beal, Ira M. Mosher, Charles S. Pierce, John E. Thayer, Jr., Philip M. Tucker, John C. F. Wheelock, B. Loring Young and Richard Lennihan. Mr. Beal is president; Mr. Young, secretary, and Mr. Lennihan, treasurer. Fourteen hundred hands are now employed.

OTHER LOCAL INDUSTRIAL ENTERPRISES

The Dresser Manufacturing Company and the Central Mills Company enjoyed a joint existence of more than a century, and when the latter corporation sold its properties to the Hamilton Woolen Company a few years ago, cotton sheeting and twine constituted the products manufactured by the 15,828 spindles, and 520 looms which constituted the plant equipment at that time. The Central Mills Company succeeded the Central Manufacturing Company which concern erected its original mill in 1837.

In the management of the Central Mills Company, Former Congressman Hon. Calvin D. Paige and his son, John Edwards Page, were active for many years.

THE LITCHFIELD SHUTTLE COMPANY

On May 1, 1843, Festus, Laroy, Pliny, and Libya Litchfield, with their brother-in-law, Schuyler Whitney, began the manufacture of shuttles, at Globe Village, but two years later they purchased a water privilege, at what is today known as Shuttleville, and built a plant, which today is operated by the Litchfield Shuttle Company, employing 125 operatives.

In January, 1928, the concern which had been owned and managed by Southbridge interests, for nearly ninety years, was sold to a group of

Boston, Maine, and New Hampshire men, and new officers were chosen, as follows: Albert Stone, Jr., of Boston, president; George A. Littlefield, of Southbridge, vice president; A. E. Leon, of Belmont, treasurer, and Joseph M. Brennan, of Boston, clerk, these four, with E. H. Neal, of Rochester, N. H., George B. Chadwick, of Portsmouth, N. H., and John C. Stewart, of York, Maine, constituting the board of directors. The present officers are: president, Henry B. Montague; vice president, treasurer and superintendent, George A. Litchfield. The concern employs 125 operatives.

THE CLEMENCE AND PARKER WIRE GOODS COMPANIES

The Clemence Company capitalized for \$50,000 and employing fifty hands, in the manufacture of wooden boxes and builders' finish, is the outgrowth of the Clemence Box Shop, which was established in 1850. The corporation has capital of \$90,000. M. B. Clemence is president and J. B. Clarke, treasurer and secretary.

Stephen Richard, founder of the cutlery business, which bears his name, began the manufacture of shoe and leather knives, in 1861, in a primitive plant where the forge, the anvil, the hammer, the foot lathe, and the grindstone were the chief tools. Increased business necessitated removing from the original shop in Bridgeville to larger and better equipped quarters in Southbridge, and eventually paring, bread and meat knives, cleavers, hunting, cloth, rubber and putty knives were added.

In 1917 the Richard family sold the business and it was incorporated and further enlarged.

This modern plant with two-thirds of a century of production behind it was bought in 1928 by the Parker Wire Goods Company, of Worcester, but the Southbridge unit is operated entirely apart from the Worcester plant of the Parker Wire Goods Company.

THE HYDE MANUFACTURING COMPANY

In 1875, Isaac Perkins Hyde established the firm of I. P. Hyde & Co., locating his plant at the lower end of Elm Street, where for some years he confined his production to the manufacture of extension blades and shoe knives, used by cobblers and cutters of upper leather. The brand name "I. P. Hyde" stamped on the extension blades, soon was recognized as standard by the trade. It was not unusual for Mr. Hyde to make up a quantity of these blades and journey to the shoe cutters in Boston, Lynn, Haverhill, Salem and other shoe cities and towns, and offer his wares.

In 1881 the company had grown to such a size that a larger plant was required, and the land and buildings, at 35 Main Street, were purchased. That year the Hyde Manufacturing Company was incorporated.

In July, 1917, a modern brick plant was erected on Eastford Road, designed along the most modern type, and it stands today as one of the largest structures exclusively devoted to the manufacture of tools for cutting leather, rubber and cloth. Three additions have been built in the intervening years, affording a floor space of upwards of 40,000 square feet and permitting the company to develop new lines of production, including household cutlery in both stainless and carbon steel, marketed under the "Hyde" brand, these commodities enjoying the same reputation for quality as the famous tools produced for over fifty years.

Recently the increasing demand for tools used by painters and paper hangers has been recognized by the company and a complete line of these devices is now marketed under the "I. P. Hyde" brand. The concern employs upwards of one hundred operatives and has capital of \$100,000.

Joseph La Croix is president; Myron B. Clemence, treasurer, and Arthur J. La Croix, superintendent and clerk.

The Harrington Cutlery Company, one of Southbridge's oldest industries, is capitalized for \$90,000 and affords employment to 115 men, in the production of high-grade cutlery. The corporation is now controlled by officials of the American Optical Company. J. Cheney Wells is president; Channing M. Wells, vice president; Irving L. Rich, secretary and Ira Mosher, treasurer.

The Du Paul-Central Optical Company was formed in 1900, and is capitalized for \$300,000. It employs seventy-five hands in the production of spectacles, eye-glasses and industrial goggles and occupies a modern plant especially adapted to its requirements. George H. Du Paul is president; Renaldo Guilmette, vice president; Hector M. LeClair, treasurer and John W. R. Crawford, secretary.

In 1929 the Independent Optical Company acquired the assets of the Nomar Optical Company and the same year it bought the plant of the Shur-On Optical Company to which factory the business of the Nomar concern was moved.

Daniel P. Bernheim is president and treasurer of the Independent unit, which has made great strides within recent years. C. E. Drew is vice president and Arthur L. McKinstry, secretary.

The Quality Lens Company, owned by Wilford Lavoie and William Boyle manufactures optical lenses.

Sheet metal products are manufactured by the Southbridge Roofing Company, which is capitalized for \$50,000. Twenty-five operatives are employed. R. M. Proulx is president and secretary, and A. E. Proulx is treasurer.

In 1927 the Southbridge Finishing Company was incorporated to bleach, dye, print and finish cotton piece goods. Bernard Goulding is treasurer and H. W. Wilkinson, general manager. The plant has a capacity of 2,500 pieces per day, is one of the most modern in equipment in Worcester County, having ten printing machines, six boilers and two water-wheels and employs upwards of three hundred fifty operatives.

It was here, in the village of Sandersdale, that James Sanders established the Sandersdale Print Works in 1867, which continued in operation the greater part of the time for sixty years thereafter, the plant being taken over by the New York group in 1927.

DANI & SOLDANI

In 1914 Messrs. Eugene Dani and John Soldani opened a small shop on Elm Street, where they specialized in cabinet and pattern making and carried on all kinds of woodwork. Gradually the company began to confine its activities to the manufacture of counter display cabinets and by 1926 the business had expanded to such an extent that it became necessary to move to larger quarters. The firm purchased the factory formerly occupied by the Optical Lens Company, Inc., situated at 484 Worcester Street, containing manufacturing space of 6,420 square feet, with two large lumber sheds in addition.

For the past few years the firm has been engaged in filling orders for some of the leading manufacturers of the country and affords steady employment to about forty hands.

SPENCER—THE BIRTHPLACE OF THE INVENTOR OF SEWING MACHINES

Elias Howe, Jr., the creator of the sewing machine—one of the great inventions of modern times, was born in Spencer, in 1819. His father was a farmer and a miller, and young Howe aided him in these pursuits, attending school in the winter until he was seventeen years old, when he was apprenticed to become a machinist. When he had attained his majority he married and not long after he conceived the idea of making a machine that would sew, at which he diligently labored in all spare hours after the day's labor. At one time, while in Lowell he earned but 50 cents a day, and when his wages were increased to 62½ cents he stated that he felt about as well pleased as he did in after years when world-wide fame came to him. For five years he experimented on the various movements of the device, and on the 10th of September, 1846, while living in Cambridgeport, he obtained his initial patent on the first practical sewing machine. "Singularly enough," says an English chronicler, "his fellow-countrymen did not at once see the merit of his invention and its introduction to the public was first made in England. Shortly after his patent was obtained he sent over a machine to this country and disposed of the English patent to Mr. Thomas, for, we believe 200 pounds! Mr. Howe himself visited this country soon after the arrival of his machine and superintended its adaptation to the work required to be done by Mr. Thomas—staymaking. Beyond the 200 pounds, we do not see that poor Howe did any good for himself over here; for in 1849 he returned again to America, so poorly off that he was obliged to work his way home before the mast."

On his return to the United States, he became involved in a number of expensive lawsuits to establish the validity of his patent and it was not until 1853 that he was granted his first license. Thenceforward fortune began to smile upon him, and in 1855 he had repurchased all the patents he had sold during the period of adversity. He received a royalty on every sewing machine manufactured in the United States and it was estimated that his income from this source was not less than \$250,000 a year—a large prize for a humble mechanic to win—but yet incomparably trifling compared with the benefit conferred upon the world by the gift of his labor-saving machine.

The chief factor of his invention was the use of a needle with the eye on the point and a shuttle for the purpose of uniting two edges in a seam or their equivalent, producing a stitch by interlocking two threads.

In 1863 he organized a company, of which he was president, and erected a large sewing machine manufactory at Bridgeport, Conn., but the heavy expenses of litigation, which he was forced to undertake to enforce his priority claims, dissipated his fortune and he died in comparative poverty.

It seems appropriate that his native town should become the habitat of numerous shoe producing concerns, all using adaptations of the original sewing machine which conferred such a boon upon the shoe industry.

Spencer is indeed proud of the fact that it is not only the birthplace of Elias Howe, but also of his two brothers, Tyler Howe, the inventor of

the spring bed and William Howe, who designed and produced the truss bridge. On the lawn in front of the Spencer town hall is reared a bronze and granite memorial, bearing in bas relief, the faces of this great trio of American inventors, while the old Howe homestead of South Spencer, bears a bronze marker designating the spot as the birthplace of Elias, Jr., Tyler and William Howe.

THE GREEN AND PROUTY ENTERPRISES

Josiah Green, who has been called the founder of the wholesale peg boot and shoe business in this country, was born in Leicester, August 9, 1792, and removed to Spencer in 1812, where he began the pegging of boots, fastening them with wooden pegs which, at the outset, he fashioned with a common shoe knife. This method continued until machine sewing came in. In 1874, Green erected a large factory in the town, over which he displayed a sign reading: "Josiah Green, Boot Manufactory, Established in 1812."

Following his death in 1876, the business was carried on by his sons, and for many years 175 operatives were employed.

In 1820 Isaac Prouty established himself in the town as the village shoemaker, employing one or two journeymen and executing orders by hand. A few years later he built a modest three-story shop, 30 by 60 feet, introduced such labor-saving devices as had then been perfected, and augmented his force of employees. He next erected a frame structure of four stories, 42 by 104 feet, which forms today the front of the big Main Street shop, now 42 by 485 feet, the additions being of brick six stories in height with a warehouse of brick, 60 by 400 feet, six stories high and another brick structure adjoining, 60 by 300 feet.

Mr. Prouty died in 1872, but the ownership and control of the company has remained in the family for 110 years and as early as the late '80s the annual sales had risen to \$2,000,000. The present firm name, Isaac Prouty & Co., Inc., was adopted in 1856. Today, 400 hands are employed. The company also operates a tannery where the greater part of its leather is produced and a box manufacturing shop and the corporation has capital of \$479,700. C. Newton Prouty is president; J. W. Prouty, vice president and R. D. Esten, treasurer and secretary.

In 1841 Asa T. Jones founded the business later known as E. Jones & Co., which employed 200 hands in the manufacture of shoes in its heyday. The factory is now one of the Spencer units of the Allen-Squire Company.

In 1884 Dustin & Clark began the manufacture of boot and shoe machinery in Spencer.

In 1885 A. B. Bacon and E. F. Sibley formed the firm of Bacon & Sibley and engaged in the production of shoes in the Main Street factory, now occupied by Allen & Squire Company and employ 100 hands.

A MODERN SHOE EPIC—THE ALLEN-SQUIRE COMPANY

The story of Allen-Squire Company of Spencer reveals what two sons of the Bay state, both graduates of one of her honored institutions—the Massachusetts Institute of Technology—can do with an idea in a dozen years.

In 1916 Charles E. Allen, a native of Spencer and Edmund H. Squire, a native of Sharon, incorporated The Allen-Squire Company, took over an abandoned shoe factory in Spencer, having a capacity of 1,000 pairs a

day and entered upon the manufacture of men's and boys' Goodyear welt and nailed shoes for hard wear and in less than a dozen years the concern has grown to occupy four Spencer factories, to increase its output to 6,000 pairs a day and to take rank as the largest producer of work shoes in New England. An annual payroll of \$500,000 goes to 500 hands, where twelve years ago only idle factories stood and \$220,800 in invested capital has been planted in buildings and equipment. The plants formerly owned by E. Jones & Co., Emery & Sibley, the Barr Heel Company and the Green Underwear Company, together with a large four-story brick addition to the Jones shop now hum with the company's machines. Edmund H. Squire is president; Frederick B. Fraill, vice president; N. E. Craig, secretary and Charles E. Allen, treasurer.

THE BEGINNINGS OF THE SPENCER WIRE COMPANY

On Seven Mile River, is located Spencer's largest water-power and it was here the first mill erected in the town was built by James Wilson in 1740. In 1812 Elliot Perry began to draw wire there in a small mill, which he had built in order to supply the card factories of Leicester with the wire they could not longer import from England, due to the war with the mother country. Beginning about 1820 the Messrs. Bisco continued the business and in 1845 Richard Sugden, an English immigrant, and a wire drawer by trade, found employment in H. A. Denny's wire-drawing plant in Cherry Valley.

Two years later he and Nathaniel Myrick formed the firm of Sugden & Myrick and in 1870 the former purchased another plant in Spencer, which had been operating since 1830 under various owners and formed the Spencer Wire Company. Upon Mr. Sugden's death in 1895, Harry W. Goddard succeeded to the management and under his administration the growth of the company was phenomenal. By 1917 the capacity of the Spencer unit was about 13,000,000 pounds and in 1899 a large unit was erected in Worcester, which in 1917 had grown to consist of twenty buildings, with manufacturing space of seven and a half acres. The Spencer Wire Company was taken over in the merger of the Wickwire-Spencer Steel Corporation.

In 1912 the Bigwood Woolen Company began operations in the Upham Mill and in 1919-20 made material additions to the original plant. It employs seventy-five hands, has capital of \$90,000 and manufactures men's wear goods and cassimeres. Mellen H. Albro is president; W. E. Bigwood, vice president and David Bigwood, treasurer and secretary.

The Phoenix Paper Box Company, owned by W. H. Potter, employs forty operatives in the manufacture of paper boxes. R. B. Stone & Co., owned by Ralph B. Stone, employs thirty-five in the production of boxes and shooks; and the the Tower Paper Box Company, owned by DeWitt Tower, carries fifty operatives on its payroll in the manufacture of paper boxes.

Alfred and William Dufton, operating as Dufton Brothers, are engaged in the manufacture of woolen fabrics.

In the olden days two local woolen mills produced 34,000 yards of cloth, valued at \$87,000 in 1837; a shoe factory, employing 190 hands, manufactured that year 52,091 pairs of boots and 2,940 pairs of shoe, valued at \$106,496; four wire-drawing mills, employing ten workers, made nineteen tons of wire per year, valued at \$10,480 and two powder mills

produced 162,500 pounds of powder, valued at \$14,500, these industries disappearing in 1853 when the plants exploded.

THE INDUSTRIES OF STERLING

In 1837 Sterling had twenty-four manufactories of chairs and cabinet ware, but they employed only eighty persons in the aggregate, the value of the commodities that year being \$53,228. Some 22,500 palm-leaf hats were made there that year and \$5,000 worth of scythe snaths.

Thurston and E. R. Buck founded the chair manufacturing concern known as T. & E. R. Buck sixty years ago and during its entire career this enterprise, tucked away in the little farming town of Sterling, has made a specialty of producing larger quantities of chairs for memorable occasions than perhaps any other unit of its kind in the country. The chairs that were used at the dedication of Grant's Tomb on the Hudson; those for the inauguration of President Theodore Roosevelt in 1905; those for the Baltimore convention of the Y. P. S. C. E. and 10,000 for the Johnson-Jeffries pugilistic encounter at Reno, all came from the Sterling plant. The concern owns hundreds of acres of woodland, from which it cuts its timber, over 1,600 acres being located in Princeton, Sterling and Holden, the Buck enterprise being the largest taxpayer in the first-named town. Forty operatives are employed. Since the deaths of the founders, H. T. Buck has managed the business.

Thurston Buck, one of the founders, was not only regarded as one of the scientific lumbermen of Massachusetts up to the time of his death in 1929, but he was accounted as a pioneer New England chair manufacturer.

He was of that rare type of business man who has the economic welfare of the community at heart and he realized the inherent wealth of Worcester County's forests, as well as the necessity of conserving them. He seemed able to see beyond his own generation and the building up of forest reserves was close to his heart.

Unlike many other forest owners, Mr. Buck discounted the benefit of tree planting. Preferring to work with what nature had already set out he practised natural forestry. Trees should never be planted, he averred, but assisted in their growth. This policy he worked out in his large woodland tracts in the towns of Holden, Princeton and Sterling. This unique method of forestry caused much comment among forestry experts many of whom refused to be convinced until Mr. Buck proved to them conclusively that trees could be raised without being planted.

The owner of more than 1,600 acres of forest in the vicinity of Mount Wachusett he spent a great deal of time among them, weeding out the poorer ones and aiding the most promising. In felling his trees he always cleared the ground in the vicinity so that the seeds might take hold on the fertile ground. This method after being watched with a great deal of interest by authorities was found to be successful and at his death he left standing behind him one of the largest tracts of forestry in all New England.

Laboring hard with his forest, Mr. Buck soon became handy in the knack of felling, logging and sawing trees, while his judgment in forestry was sought frequently by state and national authorities and annual inspections of his forest were made by these officials.

Starting in his father's factory when a boy as a worker on the saw bench he saw the shop grow steadily. Acquiring the plant with his brother,

Eugene, Thurston Buck saw his hopes dwindle when on June 14, 1883, the entire factory and more than a million feet of lumber which he had felled and made ready for use were destroyed by fire.

Not despairing he and his brother rebuilt a small shop, 35 by 40 feet the following year and with all their belongings heavily mortgaged set out to make the business bigger and better. Receiving an order for 20,000 chairs, they were forced to purchase new machinery and for many years both labored hard, drawing no salary from the enterprise. There was but one pocketbook between them and their hard and industrious labor saw the factory increase in size from year to year until today it occupies more than 18,000 feet of floor space.

When the business started on its upward growth the firm of T. and E. R. Buck was formed and up to the time of his death, Thurston Buck was its active head. Two years after the death of his brother, Eugene, Mr. Buck bought his family's interest and became the sole owner, under the same firm name, which has never been changed.

Within the past decade, the Hildick Corporation, of New York City, a \$900,000 corporation, located a substantial plant, at Sterling Center, where cider vinegar and sweet cider are produced, and to which apple growers throughout Worcester County bring the products of their orchards. Walter H. Hildick is president and Howard E. Kerr, treasurer.

THE MANUFACTURES OF STURBRIDGE

About 1811 the grist mill, owned by Moses Fiske at Westville, passed to the Sturbridge Manufacturing Company, which established the first cotton mill in that vicinity, installed 128 spindles, and a double wool-carding machine in 1812. The Westville Manufacturing Company took over the property in 1833.

By 1837 Sturbridge had six cotton mills, equipped with 8,604 spindles and employing 188 hands, the total production that year being 829,749 yards of cotton cloth.

Much is said and written these days concerning new textile units being established in the South, but the rejuvenation of old established Massachusetts units is constantly occurring, although infrequently exploited. The Quinebaug Company, of Sturbridge, formed by Henry and Harvey S. Fiske, who built the first factory structure and laid the foundations of the village of Fiskdale, in Sturbridge, was first operated in 1829, the original mill being 84 by 90 feet, five stories in height. In 1835 the Quinebaug Company was merged with the Sturbridge Cotton Mills, which were incorporated with \$100,000 capital.

At that time the upper dam was built and a new stone mill erected. On its enlarged basis the plant had 10,000 spindles and 200 looms in operation. Due in large measure to the troubles succeeding the panic of 1847, the concern experienced a long period of depression, but in 1859 the mill entered upon a new period of prosperity. The corporate name was changed to Fiskdale Mills in 1869, the authorized capital was increased to \$500,000, and new units were built.

In 1885 the Fiskdale Mills employed 286 persons, operating 34,000 spindles and 800 looms. This number of machines was maintained, with slight additions, up to the suspension of operations a short time before the opening of the World War.

On May 2, 1927, the plant which had been idle the greater part of the

time since 1914, was reopened by the Sturbridge Finishing Company, a new corporation formed by Golding Brothers, of New York, who purchased the property the previous September, when they also bought the mill property of the Southbridge Finishing Company of Southbridge. The new owners expended about \$350,000 for new equipment, including a forty-ton steam generator, motors and other machinery. The plant is engaged in bleaching, dyeing, printing, mercerizing and finishing tickings, dress goods and shirtings, and has a daily capacity of 75,000 yards. Approximately one hundred fifty employees found work, and it is anticipated that this number soon will be increased to 250. Joseph Golding is president, and Bernard Golding, treasurer.

THE SNELL MANUFACTURING COMPANY

In 1790 Thomas Snell, of Bridgewater, began the manufacture of augers in a blacksmith shop, established or acquired by him, and located on Flat Brook, between Ware and Hardwick.

The father of seventeen children, he was an unusual man in various respects. He owned a 135-acre farm in Flat Brook Valley and besides blacksmithing, he also operated a grist mill.

The augers made at that time and at a somewhat later period were mostly iron, with a steel cutting part welded on the end and the shank long and rough. The product was taken to Boston to be sold, and a load of iron, steel and other supplies was taken in exchange and brought back. The volume of business increased gradually and in 1837 it was reported that \$4,500 worth of augers and bits were being made annually. When the industry was running at its best some twenty men were employed.

The industry founded by Snell was continued by his sons, Thomas, Jr., and Melville. The latter went to Providence in 1839 and manufactured augers there for two years. He then settled in the part of Sturbridge, later known as Fiskdale, where he was joined by his nephews, Otis and Lucius, and in 1854, by his brother, Thomas Snell. The auger industry was continued in that place, known as Wight Village. In 1799 a canal half a mile in length was dug to conduct water from the Quinebaug River, where a dam was built, to a place on the main highway, where a sawmill, grist mill and woolen mill were established. There the Snells found a site that suited their needs. Lauriston Towne entered the partnership and the concern was known as Towne, Snell & Co. Judson Smith succeeded Towne, who withdrew and the firm name became Smith, Snell & Co. Later Smith retired and ownership was lodged in the Snell family, and the concern became Snell & Brothers.

The shop in which operations were begun was burned in 1852. The mill privilege was purchased and a two-story stone mill, 32 by 100 feet, was erected. A three-story stone building, 45 by 100 feet, was erected soon afterward, and also a smaller building. With his enlarged plant and with the accession of Thomas Snell, who came from Ware to become a partner, the industry was conducted on a greater scale than ever before and seventy-five operatives were employed in 1855.

The era of wooden shipbuilding provided a large and steady demand for Snell augers, and they were also in constant use in the building of houses, stores and factories, wooden bridges, and railroad cars. Wooden pegs were then largely used instead of screws and bolts, and the well-made auger produced a hole into which these pegs fitted with exactness.

In 1862 Emery L. Bates, of Fiskdale, and Clark & Wilson, a New York hardware firm, acquired the business, and the concern became the Snell Manufacturing Company.

Bates had been a shoe manufacturer, and his trade being largely in the South, he suffered heavy losses by the Civil War, so that he was forced to give up that business. The established prestige of Snell augers enabled him to revive his fortunes and though wooden ships had been superseded by iron vessels, the growing and broadening industrial interests of the nation in the period following the Civil War brought a heavy demand for such tools as the Snell firm manufactured.

Gradually the line was extended to cover a great variety of special needs. Augers, bits and gimlets of many shapes, styles and sizes were produced. A line of augers for gasfitters and used for boring through thick plastering; a line for steamfitters, made for use in a ratchet wrench for boring holes for steam and gas pipes; others for electricians' use, and still others for earth boring and ice cutting have been developed. There are various styles for ship and car builders, for oil-well derrick builders and deep boring work, for millwrights, for wharf construction and for tapping maple trees in the sugar orchards.

Many of the products are forged from crucible steel and given a high polish. Power machine bits and patent boring machines are produced in variety. Cold chisels and bits for metal use as well as for woodworking uses are manufactured and more than 1,000 numbers are listed in the latest catalog.

Owing to the breadth and diversity of its market the Snell Manufacturing Company has maintained a comparatively steady production amid the ups and downs experienced by many lines of industry. Improvements have been made constantly in the product to keep it abreast of the times. Exactness is stressed as an indispensable requirement.

Having survived two serious fires and encountered many radical changes in the industrial world, the Snell Manufacturing Company is now in possession of more plant space than in any previous period. It employs approximately 150 persons when operating at normal. In 1907 a new plant was erected on the site of the old factory.

The present management of the concern dates from 1910. W. K. Wilson of New York is president and L. S. Whitney of Fiskdale is treasurer, vice president and manager. The corporation has capital of \$240,000.

A signal contribution was made by the Snell Manufacturing Company in the restoration of the frigate *Constitution*, which was carried on in 1928-29, at the Charlestown Navy Yard. An assortment of augers and bits was ordered by the commandant for use in the reconstruction work. It was fitting that this Fiskdale concern should be called upon for its services inasmuch as Thomas Snell, its founder, is said to have been the first in America to make spiral augers and the first in the world to make the improved bight auger that brought widespread demand for the product. He started his industry four years before the first act of Congress was passed to provide for the building of a navy and seven years before the *Constitution*, one of six 44-gun frigates that were authorized at about the same time, was launched.

As the *Constitution* was built in Boston and as Snell was the only manufacturer of bits and augers adapted to shipbuilding use in the vicin-

ity, it is probable that his tools were used in the construction of the frigate. The Fiskdale establishment, almost as old as the government itself, played its part in the restoration of the historic vessel, and it is anticipated that its name and those of other concerns similarly aiding in remodeling the ship will appear on a bronze tablet to be put up in the frigate when restored and refurnished and with sails and rigging complete, she is exhibited in ports throughout the country.

In 1928 the Mason & Parker Manufacturing Company, of Winchendon, purchased the No. 2 mill of the old Fiskdale Manufacturing Company, in the village of Fiskdale and immediately installed machinery.

The mill contains 55,000 square feet of floor space, fully protected by a sprinkler system and the factory has its own fire pump, boilers and water-wheels, capable of 400 horse-power.

Until a few months before the plant was used as a branch of the Hamilton Woolen Company, of Southbridge. Located on the Quinebaug River, the purchase included, in addition to the building, full water rights at the plant, a half-interest in the flowage rights of several reservoirs, a half ownership in the village reservoir which supplies the town with drinking water and also water for fire protection.

A year later, the physical assets were sold to the Sturbridge Finishing Company, which desired to augment its production facilities, and the Mason & Parker Manufacturing Company acquired that year the idle plant of the American Woolen Company at South Royalston, which is located much nearer to the parent unit.

In 1928 Alfred Montville began the manufacture of marble setters, tile and brick layers' tools, radio tools, cold chisels and punches.

SUTTON'S IMMORTAL GENIUS—THOMAS BLANCHARD

It may be questioned whether, during the last century another inventor can be named in America, or in Europe, who produced so many different labor-saving machines, applicable to a greater variety of uses and which contributed so largely to the common necessities, comforts and economies of life, as those of Thomas Blanchard.

Every armory where guns are made in the United States and England; every man and woman who wears shoes; every vessel that sails the seas; every school that uses slates; every building and dwelling where carpets are used, owes a tribute to his genius.

Likewise, carriage wheels, plows, shovels, many articles of furniture, carving, architectural designs, statuary, machine shops, wood-working establishments, all owe Blanchard something for his contributions.

Born in Sutton, June 24, 1788, of French origin, and the son of a poor farmer, there are almost as many claimants for the honor of his birthplace as there were in Homer's era, when seven Grecian cities contended and actually waged war in an attempt to substantiate their claims. Sutton, Millbury, Oxford, Springfield, Boston, and lastly, France, are attributed by various writers as being the place where he first saw the light of day, but it seems clear that the home of his father was on a strip of land lying between Sutton Township and Oxford proper, called "Oxford Gore," which, according to ancient maps was well within the municipal territory of the former town. The records show that his father paid his taxes in Sutton; that the births of most of his children are recorded there,

and that the son, Thomas, always told his biographers he was born in that town.

True it is that he began his industrial career in Millbury, and later lived in Springfield and in Boston. It was in Millbury that he invented his tack machine, and there that he began his work in Asa Waters' armory, where firearms were manufactured for the government. Waters had been engaged for some time in making improvements upon the English process of producing gun barrels, which welded them by hand and next ground them down before a revolving stone. Waters had invented a process of welding them by water-power under trip-hammers, which he had patented October 25, 1817 and he next invented a machine for turning the barrels, so as to leave the metal of uniform thickness around the calibre, as it had been ascertained that in grinding often one side would be left too thick, while the other would be too thin, thus enhancing the liability to explode. He received a patent on this process December 19, 1818.

To turn the barrels so as to produce irregular shapes at the butt Waters could devise no invention, but he was not alone in this failure, as the most ingenious mechanics in the national armories had long tried to solve the problem, but without success. Learning that Blanchard was in that part of Sutton, which is near West Millbury and that he had shown inventive genius, he sent for him and found him to be an uncouth, diffident, and stuttering young man. Shown the machine and informed as to what was wanted, he soon suggested an additional, very simple, but wholly original, cam motion, which, upon being applied, proved to be a perfect success. Waters was immensely pleased and turning to the youth, said: "Well, Thomas, I don't know what you won't do next. I should not be surprised if you turned a gun-stock!", suggesting this as the most impossible inventive feat that came to his mind. Blanchard hesitated a moment and stammered out: "We-we-well, I-I-I'll t-t-try that," only to receive the loud guffaws of the workmen, who were amused at the very absurdity of the idea. But they knew not that the young man's turn to laugh would come ere long. The germ of the machine for making the gun stock lay in the cam motion he had suggested, and, as Thomas Blanchard afterwards said, it was then and there, that the idea of his world-renowned machine for turning irregular forms first flashed through his mind, although some months were required to elaborate and produce it as a mechanical entity.

Called to Springfield to adjust motions in the United States armory similar to those he had applied to Waters' machine, he was on his way back home, alone in a carriage, when, passing through Brimfield, he was heard to cry out, like Archimedes of old: "I've got it! I've got it!" only to have one of two bystanders who heard him say to the other: "I guess that man is crazy." With the proceeds received from the sale of his tack machine, Blanchard had built a workshop and filled it with tools. Here, for the better part of two years he locked himself in while he worked on his lathe, which, at last was finished. Carrying a miniature model of it to Waters, the gun-maker was so impressed that he urged Blanchard to make a full-sized machine in his shop, which was done. The fame of it reached Washington, D. C. and the War Department urged that it be launched with some publicity at the Springfield arsenal. Blanchard's pride was aroused, and a three-horse team, driven by Horace Waters of

Millbury, took it over the road, and after the lathe had remained at Springfield long enough to build a second one, it was carted back to Millbury, bought by Mr. Waters and set up in his shop, where it was operated for a quarter of a century.

Blanchard was called to Springfield and given charge of stocking the guns, and it was at the armory that he expanded and extended the principle of the lathe, first to letting in the barrel, then the mounting and finally the lock, which the expert "stockers" said could never be accomplished by machinery, but which Blanchard proved otherwise.

Soon his machine was desired by shoe last manufacturers, next by tackle-block makers, then by wheel spoke and ox-yokes manufacturers and so on *ad infinitum*.

He had discovered a new principle in mechanics and had produced a machine that became the obedient servant of mankind to work out designs, upon any given model—round or square—crooked or straight, no matter how irregular—and which inaugurated the uniformity system that represented an era, perhaps the most significant since the introduction of the steam engine, as mechanical processes were revolutionized by the abandonment of the old numbering system which no longer was necessary.

During the first two years of his patent, Blanchard was harassed by infringements and law suits, more than fifty violators pirating his invention. Combined and repeated efforts were made to break down the patent, eminent counsel being engaged to scour Europe for evidence of a similar motion, but in no age or nation could a trace be found of a revolving cutter, working to a given model, that bore the slightest resemblance to Blanchard's device.

When the second term of his patent had nearly expired he announced that he had expended \$100,000 in defending his rights and had barely gained a fair living from his invention. Realizing that a third grant was unprecedented, he fitted up a machine for turning busts from marble blocks, took it to Washington, obtained plaster casts of Webster, Clay, Calhoun and others and exhibited the busts in the Capital rotunda. The members of Congress expressed astonishment when they found the busts were wrought by machine, and when they inquired of Blanchard whether he had produced a new machine, he frankly said "No—not a new invention, merely the application of an old one of mine, from which I have realized little, and I want the patent renewed."

Daniel Webster introduced a resolution in the Senate to extend it for a term of years, and it was rushed through quickly, whereupon Rufus Choate was heard to say that "Blanchard has *turned the heads* of Congress and gained his point." It was in Springfield that Blanchard invented a new type of construction of steamboats, whereby vessels could circumvent rapids and shallow waters, the idea being adopted generally on western steamers.

It was in Boston, where he removed to spend the rest of his years, that he devised the process of bending timber to any angle required, without impairing its strength—an invention which was at once applied to the keels of vessels, school slates, wheel fellies, arm chairs, shovel handles and other commodities, and although infinitely less important to the mechanical world than his eccentric lathe, he sold one right for ship-building for \$150,000, and his commissions on school slates averaged over \$2,000 per annum for a term of years.

Although he received twenty-four patents. Blanchard died without heirs.

SUTTON'S INDUSTRIES

As early as 1787 the Messrs. Burbank located a paper mill on Mill Brook, and by 1793 the town of Sutton had seven trip hammers, five scythe factories, one axe and one hoe concern and several nail factories, all located on the same stream which also supplied power to the local paper, oil, fulling, powder, grist and saw mills thus rendering the town famous for its manufacturing units of that era.

In 1825 Jefferson Bellows began the manufacture of shuttles in Farnumsville and during the more than a hundred years that have since elapsed the business has been carried on by successive owners, including Ruggles & Fowler, Fowler, Pratt & King, Sumner Pratt & Co., the Wilkinsonville Shuttle Company, Chase & Dudley, Chase & Wilder, Wilder & Co., and finally the D. T. Dudley & Son Company, which concern assumed the manufactured 30,000 yards of woollens, valued at \$30,000; boot factories, at Wilkinsonville, in 1836. The concern employs forty hands at the present time in the production of shuttles and shuttle irons. The company has capital of \$40,000. L. E. Chase is president and treasurer and Daniel W. Chase, secretary.

At Wilkinsonville is one of the plants of the Springdale Finishing Company, of Canton, and here the mercerizing and bleaching processes of fine cotton and silk fabrics are carried on.

Three old mills, formerly owned and operated up to 1922 by B. B. & R. Knight Company, in the Village of Manchaug, originally equipped with 35,744 ring and 14,096 twist spindles, and 1,234 looms, were sold at auction on August 23, 1927, to George Lichtman, a woolen operator of Woonsocket, R. I. and William J. Brady, head of the Waucantuck Mills, Inc., of Uxbridge. Later, Mr. Brady disposed of the smaller mill containing 75,000 square feet of floor space, to B. Cohen & Co., of Chicago, which concern uses it as a distributing center for its New England and eastern business.

THE INDUSTRIES OF TEMPLETON

In 1837 the town of Templeton had a woolen mill, which that year manufactured 30,000 yards of woollens, valued at \$30,000; boot factories, which turned out 9,280 pairs of boots, valued at \$22,327; palm-leaf hat shops that manufactured 117,304 hats, that were worth \$22,108; a chair manufactory, employing twelve men, that produced commodities valued at \$12,586, a tinware shop, a shovel, spade, fork and hoe factory, an air and cupola furnace, and eleven sawmills, that produced in the aggregate commodities valued at \$16,040.

In 1870, C. Aylmer Smith, Lorey D. Day, and Charles Day, formed a partnership, known as Smith, Day & Co. Twenty years later a warehouse was established at Detroit, Mich., with Charles Day as manager, and three years later one was located at Indianapolis, Ind., managed by the latter's son, Walter L. Day. In 1905 the two were consolidated, and business was carried on at Indianapolis, with Charles Day, as manager, this arrangement continuing until January 20, 1926, when Mr. Day died after fifty-six years of activity in the manufacture of chairs. In 1927, the corporation, known as Smith, Day Company was formed, with Lorey D. Day, as president; Frederick W. Day, as vice president; C. A. Smith,

as treasurer; Clarence E. Day, as assistant treasurer, and Frederick L. Hager, as secretary. Clarence E. Day is manager of the Indianapolis house.

In 1844, William G. Shattuck began the manufacture of school and special furniture on Salem Street, in the North End of Boston, later building a factory in Weston, where operations were carried on until 1905, when it was destroyed, but rebuilt. Larger quarters becoming imperative, the concern, which had passed through a number of partnerships, became known by its present-day title, Kenney Brother & Wolkins, Inc., in 1925, and removed its factory operations to Baldwinsville, where they are now carried on under modern conditions. Henry S. Wolkins is president; Ralph Kenney and John J. Collins, vice presidents; J. William Gledhill, secretary; Charles C. Kenney, treasurer; William O. Kenney, assistant treasurer; Walter S. Kenney, factory manager, and Albert D. McCarthy, sales manager.

Capitalized for \$510,000, the concern employs seventy-five operatives and maintains a Boston office, at 224 Congress Street.

The Waite Chair Company, Inc., one of the oldest and largest chair factories in northern Worcester County, was bought on June 1, 1927, by A. W. and F. W. Bancroft of Gardner, and a new corporation was formed to operate the plant. It has capital of \$84,200 and employs sixty operatives. Alvin W. Bancroft is president; Frederick W. Bancroft, treasurer, and William E. Norton, secretary.

In 1928, the Children's Vehicle Corporation of East Templeton was acquired by Carl H., Knute W., and Gustaf Hedstrom of Gardner. The company which employs 300 persons was reincorporated under the name Hedstrom-Union Company, with capital of \$200,000. It employs 250 operatives at the Templeton and Gardner plants. C. H. Hedstrom is president, and Gustaf Hedstrom, treasurer.

Two years before the concern was taken over by Nelson B. Frissell, from a committee of New York and New England bankers. At that time it was in difficulties, but a "comeback" was staged and in 1927 the company showed a profit for the first time in years.

The E. L. Thompson Chair Corporation, of Baldwinsville, is the successor of D. L. Thompson & Son, which, in 1898, was taken over by Allen, Thompson & Whitney, and the following year by E. L. Thompson & Co., this partnership continuing until 1922 when the chair corporation was formed. Seventy-five operatives are employed at the Baldwinsville plant, and the concern has capital of \$125,000. Thomas Brazell is president and treasurer and John J. Brazell is secretary.

In 1904 the Hamlet Mills were established, and were incorporated in 1921, with capital of \$10,000. Cotton felt and bagging, cotton and wool shoddies and jute batts are produced, and custom picking carried on.

E. R. Warfield is president, and A. C. Warfield, treasurer.

In 1914, Arthur L. Stuart purchased the business of Holman & Harris, tub manufacturers, and organized the Temple-Stuart Company, the concern specializing in kitchen, dining, rocking and children's chairs, and is capitalized for \$100,000. It employs seventy-five hands. Benjamin F. Stuart is president; J. B. Stuart, vice president and Carl B. Stuart is treasurer.

The A. L. Adams Paper Company employs twenty operatives, at its Baldwinsville plant, where crepe paper and toweling are produced. A. L.

Adams is president and C. J. Adams is treasurer and secretary and the corporation has capital of \$150,000.

The Otter River Board Company, with capital of \$75,000, employs sixty operatives at its plant in the village of Otter River, and manufactures binders, buttons and trunk boards. J. P. O'Brien is president and treasurer; M. E. Christian is secretary, and J. E. O'Brien, treasurer.

One of the fourteen plants of the New England Box Company is located in Baldwinsville, and the Conant-Ball Company, of Gardner, operates the former Bourn-Hadley Company's plant in Templeton.

UPTON—THE HAT TOWN

A century ago Upton was a shoe center, and in 1837 the town had a woolen mill, the annual production of which was 31,200 yards of cloth, and that year 3,100 pairs of boots and 117,699 pairs of shoes, valued at \$107,796, were produced. Fourteen thousand straw bonnets were manufactured there the same year, valued at \$35,110.

The latter industry was the germ of the firm that became famous in after years, known as William Knowlton & Sons Company, which was engaged in the manufacture of straw, velvet and felt hats for women. In its heyday from four hundred to eight hundred operatives were employed.

From 1836 when William Knowlton & Sons began the manufacture of straw hats in West Upton, to 1925 when the Merrimac Hat Corporation, of Amesbury, bought the plant and assets, one or more members of the Knowlton family were identified with the concern during the period of eighty-nine years. In the latter year, Maj. George W. Knowlton, Jr., and Harold Knowlton, brothers, withdrew from all participation in the hat business.

The founder, William Knowlton, a native of Boston, was apprenticed to James Bowker, a farmer and cooper, and at the age of twenty, he began bottoming shoes, but a year later he became a clerk in Lyman Stoddard's country store, in Upton, where, among his duties, was the buying and selling of hand-made straw braid for men's and women's hats. At the age of twenty-seven he was a partner in the firm of Stoddard & Knowlton, which was dissolved in 1836, when a new partnership was formed with William Legg, and subsequently another with Joseph Farnum, of Worcester, for the manufacture of straw hats.

A few years later Mr. Knowlton became sole owner of the fast-growing enterprise that he founded at West Upton. Neither the panic of 1857 nor the Civil War, which lost to him \$400,000 in bad accounts in the South, served to put him out of business, and shortly after the close of the war his three sons, Edwin F., George W., and Eben J. became associated with him in the firm of Knowlton & Sons, which later became William Knowlton & Sons.

From small beginnings and from domestic braids it was not long before the Knowlton concern was invading England, France, Switzerland, Germany, Italy, China and Japan in search of the best braids in the market.

The new management has continued "The Dormitory" and "The Lodge," two large buildings, the former being the transformed first factory, and in these two buildings the out of town workers reside and the employees have their social gatherings. The concern operates under its former corporate designation. The Wm. Knowlton & Sons Company, has

capital of \$250,000 and employs from four hundred to eight hundred operatives, according to the seasons. J. W. Farley is president; H. R. Guild, secretary, and B. F. Sargent, Jr., who is president of the Merrimac Hat Corporation, is treasurer of the West Upton Corporation.

UXBRIDGE—OLD AND NEW

In 1778, Richard Mowry, a mechanic skillful in many trades, began building at Uxbridge hand looms for weaving, including warping bars and all the devices then employed for making woolen, linen, or cotton cloth and the following year, Joseph Taft set up a grist mill in Happy Hollow, where corn was ground for the Continental Army. Some of the foundations are still to be seen.

It was not until 1810 that Uxbridge made its first venture in establishing a woolen mill, the factory being the second of its kind erected in the Blackstone Valley. That year Daniel Day built a factory, 20 by 40 feet, two stories high, on the water-power privilege now occupied by the plant of S. F. Scott & Sons, in Glendale, and there he began the manufacture of woolen goods which from that time to the present has constituted the principal product of the town. The original equipment consisted of a carding machine and a picker designed to card rolls for home manufacture, these being built by Artemas Dryden, of Holden.

In 1811 an addition was made to the factory, and a billy and a jenny, with thirty spindles, built by Arthur Scholfield, were installed. All the weaving was done on hand looms set up in the homes and Day's mill employees worked sixty-eight or more hours per week.

In 1825, the mill was enlarged, a canal built to it from West River, and power looms were installed by Day. A part of the original mill was occupied by Jerry Wheelock, a son-in-law of Day, and bobbins were manufactured.

The same year that Day built his factory, a mill was erected, in the village later known as Rogersonville, by Benjamin Clapp, and here the first cotton goods ever made in Uxbridge, were produced. This mill was on the Mumford River, at North Uxbridge, and in 1817, Robert Rogerson bought the plant, raised the dam and erected a factory, known as the West Mill in 1823, and another, the East Mill in 1827.

In 1814 the Rivulet Mill was built on the site of the present factory, and here the second attempt to manufacture woolen goods in the town was undertaken. The promoters of this, as well as of other Massachusetts woolen enterprises of that period, were forced to drive as far away as Vermont to buy loads of wool, and after bringing the raw material to Uxbridge, and turning it into finished products, they packed the fruits of the loom on sleds or wagons and drove to Providence, R. I. to find their market.

John and George Carpenter built a billy and a jenny for the Rivulet Mill, their factory being in what later was denominated the Shuttle Shop, because shuttles were made there. John Capron controlled the water rights on Mumford River, at this period, and was engaged in dyeing and finishing the woolen cloth woven by the families living in Uxbridge. He occupied the first Capron Building, where now the Taft block stands, and also a room in a house that stood in the center of the town.

In 1815 William Arnold and others built the Ironstone Mill, on Iron-

stone Brook, and engaged in the manufacture of cotton goods and in 1818 the Clapp cotton mill was purchased and improved by Robert Rogerson.

The next year Jerry Wheelock began building woolen machinery at his home in the east part of Uxbridge and continued in business until 1834 when the large machine shops in Worcester rendered competition impossible. One of his machines which went into immediate use in practically all of the Worcester County mills of that period was used for napping, and he also built for manufacturers in Connecticut, New Hampshire and New York.

In 1820 the Capron Mill was built and installed in it were the first satinet power looms ever constructed. Probably they were made from designs furnished by Luke Jilson, of Cumberland, R. I., who was the engineer of the mill.

The dam of the Waucantuck Mills was built on West River in 1824, and the following year Luke Taft erected the original plant, which was burned in 1837, rebuilt the next year, and bought by C. A. and S. M. Wheelock in 1846, who began the manufacture of satinets, tweeds, yarns, flannels and cassimeres.

For years the old mill and the village were referred to as "Cracker-ville," because at the "raising" of the structure crackers were served those who helped in the work.

In 1824, Seth Wheelock erected, on the south branch of Forge Brook, in Ironstone Village, a factory for carding woolen rolls.

The year 1825 also witnessed the building of the Hecla Mill, on the Blackstone River, by Amariah Chapin, Royal Chapin, Dr. George Willard, John Taft and Orsmus Taft, the dam having been constructed the previous year. In 1826 the concern was incorporated as the Uxbridge Woolen Manufacturing Company. Here again, the mill and village received an odd name which grew out of the refreshments served at the time of the "raising," and as the principal dish that day consisted of shankbone soup, the yeomanry dubbed the enterprise and locality, "Shankbone," which long outlived every participant. The original mill had a brief existence, it being burned on August 28, 1828, but it was rebuilt that year, was destroyed by fire in 1853, and immediately rebuilt, and in 1905 the property was purchased by the American Woolen Company, which operated it until 1928, when the property was purchased by the Cherry Valley Woolen Company and is now operated by that concern. The equipment consists of 140 narrow looms, 5,720 woolen spindles, nine sets of cards, a dyeing department, three boilers and three water-wheels. Hon. W. W. Ollendorff, president of the Bellingham Woolen Company of North Bellingham, is at the head of the new concern.

In 1834, Alvin Cook erected a woolen mill on Emerson Brook, and in 1837, when depression set in and the Robert Rogerson and Uxbridge Woolen Manufacturing Company's enterprises went into financial eclipse, the only local ray of hope was found in the discovery of silver on the land owned by Hyland Tucker. New York capitalists invested money in the development of the Scadden mine, a shaft was sunk which was immediately flooded, making pumps necessary, and after a few years the project was abandoned, every dollar's worth of silver taken out being said to have cost a hundred dollars.

In 1842 the Uxbridge Cotton Mills were incorporated and took over the Rogerson plant, disposing of it in 1850 to the Whitins.

In the '40s and early '50s the first local shoe shop was built on Mendon Street, the original building serving today as two dwelling houses. Joshua Garside erected another shop on Henry Street, and about 1851, he built an addition to the structure.

In 1852 Moses Taft built the Central Woolen Mill, now the Stanley Woolen Company, the original promoter purchasing at the time extensive water rights then controlled by the Blackstone Canal Company, and which he needed to secure a clear title to the power. From July 1, 1859, to January 1, 1864, the Central mill was engaged in "the manufacture of indigo blue goods for officers and suitings, all products being contracted direct to the United States government and receiving the highest commendation. The mill was run night and day upon this line of goods, requiring sixteen blue vats for coloring the wool." Other local plants of the period, notably the old Capron Mill, then operated by Robert and Jacob Taft, manufactured cloth for the Union Army.

In 1865, the Happy Hollow Mill was built on Emerson Brook, the site being identical with that of a former saw and grist mill owned by Zadok A. Taft and D. M. Lee.

The same year Bradford J. Blanchard began quarrying granite on Williams Hill, his first contract being for the stone used in building the Linwood Mill, and in 1873 he held a contract to supply \$20,000 worth of granite for use in rebuilding in Boston, after the big fire of that year. Three years later he began advertising "the beautiful Red Granite" found at his quarry, but this vein was soon exhausted. In 1918 the Blanchard quarry filled a \$250,000 government contract to furnish granite used in walling Ellis Island, New York Harbor.

THE STANLEY WOOLEN COMPANY

In 1886 the Hecla Mill was purchased by the Calumet Woolen Company and in December of that year this plant was illuminated by electricity—the first enterprise in the Blackstone Valley section to boast of such progress. The Calumet concern was liquidated in 1905 and the plant was bought by the late Arthur Wheelock, and Stanley H. Wheelock, a graduate of the Lowell Textile School, who organized the Stanley Woolen Company that year.

The story of this concern is embraced in the history of the Wheelock family, and its connection with the woolen industry of Uxbridge runs back to the building of the original Waucantuck Mill, by Jerry Wheelock, over a century ago. First manufacturing low-grade fabrics, the Stanley concern began the production of fine cassimeres and coatings and, during the World War, was the first American concern approached to manufacture thirty-ounce blue overcoatings for the French Army. After the United States entered the struggle, the mill completed contracts for 500,000 yards of khaki for the army, and later, executed large order for the Italian and French governments. For ten years, cloakings for women constituted the product, and two years ago the manufacture of suitings for young men and fancy back overcoatings were commenced. In 1923, a four-story addition was built, which more than doubled the original space available for production. Upon the death of Arthur Wheelock, in 1927, Stanley H. Wheelock became president and treasurer of the corporation. Silas M. Wheelock is vice president. The corporation has capital of \$100,000 and employs 150 operatives.

The plant is equipped with eight sets of cards, fifty-four broad looms, 3,400 woolen spindles, dyeing and finishing departments, two boilers and a water-wheel. In 1928-29 a large addition was made, which practically doubled the productive capacity of the plant.

THE UXBRIDGE WORSTED CO., INC.

In 1900 Charles A. Root started manufacturing in the Wheelocksville Mill, under the name of the C. A. Root Company, the concern being incorporated five years later, and its name being changed to Waucantuck Mills, Inc., when W. J. Brady became treasurer of the concern.



UXBRIDGE WORSTED COMPANY, UXBRIDGE

In 1905, Mr. Root, with Louis Bachmann, of New York, formed the Uxbridge Worsted Company occupying a part of what is now the Waucantuck Mills. Four years later the company purchased the mill in the center of Uxbridge, owned by J. R. and C. W. Scott, which today constitutes one unit of its extensive plant. During the World War the Uxbridge Worsted Company wove 1,445,175 yards of cloth for the United States Army, while the Waucantuck Mills provided 980,000 yards. The Stanley Woolen Company provided 389,000 yards of U. S. khaki suitings and overcoatings, 25,000 yards of Italian marine cloth and 86,000 yards of French blue overcoating, while S. F. Scott & Sons manufactured 200,000 yards of convalescent army cloth, the total yardage locally produced of all kinds of fabrics for the United States and other governments engaged in the war being 3,125,175 yards.

In 1919 the Uxbridge Worsted Company bought the Rivulet Mills from the Bridgeton Worsted Company and in May, 1923, the mills at Uxbridge, Rivulet, Lowell, Millbury and Woonsocket, R. I., were reincorporated

under the name of The Uxbridge Worsted Co., Inc. The Rivulet Mill has four sets of cards, 1,800 woolen spindles, 80 broad looms, and employs 100 operatives.

In 1928, the corporation bought the Tunxis Mill, formerly a part of the Durham Mills, Inc., at Pogonock, Conn., and manufactured worsted yarns there. The same year the Pascoag Woolen Mills, at Pascoag, R. I., were acquired, and the plant was thoroughly modernized, and automatic looms installed. A steel storehouse 114 by 42 feet was erected at the Uxbridge plant, in 1928. The equipment at the Uxbridge plant includes ten sets of cards, 72 broad and 84 narrow looms, 4,320 woolen, and 1,536 twist spindles, seven pickers, dyeing and finishing units, three boilers and a water-wheel. Here is a concern less than a quarter of a century in age, which started with nothing but an idle mill, and which, today, is capitalized for \$700,000, employs upward of 1,500 hands, and has become a leader in the manufacture of men's wear worsteds. Charles A. Root is treasurer and secretary, Louis Bachmann is president, and H. J. Walter, superintendent.

THE WAUCANTUCK MILLS

One need find no reason to be apprehensive about the future of New England textiles once he scans the record in Uxbridge. In addition to the romantic rise of the Uxbridge Worsted Company there is an entrancing story in connection with the history of the more than a century-old Waucantuck Mills, which were bought by their present owners in 1905 for \$25,000, and which were recently appraised for \$800,000, with the replacement value set at more than \$1,000,000. In the less than twenty-five years under the management of William J. Brady they have grown to more than six times their original size, and since 1922 they have been equipped throughout with new machinery.

For more than ten years the plant has run day and night, and in 1928 a big addition was made to the dye house. The mills are equipped with four sets of cards, 96 looms, two worsted combs, 2,900 woolen, 4,000 worsted and 800 twist spindles, two pickers, complete dyeing and finishing departments, and two boilers.

Emphasis on style, close contacts with markets, the ploughing back of profits into the business, use of the latest machinery, and elimination of labor turn-over through good wages are some of the reasons why the mills are constantly operating on a three shift basis.

Edward J. Brady is president, Leo Wolff, vice president; R. R. Conway, secretary; William J. Brady, treasurer, and John T. Brady, superintendent of the corporation, which has capital of \$200,000, and employs more than 500 operatives.

Uxbridge is by far the busiest manufacturing town in the Blackstone Valley.

The Davis & Brown Woolen Company, with capital of \$500,000, was incorporated in 1899, beginning business in the old mill structure erected on the banks of the Mumford River in 1820 by John Capron. It employs upwards of one hundred operatives in the manufacture of thibet cloth. A. Otis Davis is president and treasurer and C. E. W. Matthews, superintendent. The plant is equipped with six sets of cards, ninety narrow looms, and complete dyeing and finishing departments, two boilers and a water-wheel.

S. F. Scott & Sons, Inc., was incorporated in 1919, with capital of \$500,000, and manufactures union cassimeres and suitings at the Elmdale Mill. The plant is equipped with five sets of cards, 82 narrow looms, three pickers, 1,680 woolen spindles, dyeing and finishing units, one boiler and one water-wheel, and employs 100 operatives.

Rodney H. Scott is president and treasurer, S. A. Scott, clerk, Samuel R. Scott, assistant treasurer and agent, and H. J. Holbrook, superintendent.

Jerome B. Farnum & Son produces flocks and waste at its South Uxbridge plant. Six cutters, three dusters, a picker, a boiler and a water-wheel are included in the mechanical equipment. J. E. Farnum is the owner, and L. E. Thayer is superintendent.

THE MANUFACTURES OF WARREN

In 1793, the Quabaug River, in Warren, provided water-power for two grist mills and a sawmill, a scythe plant, a fulling mill and a forge.

In 1812, a powder plant was built on the site now occupied by the Warren Steam Pump Company, but an explosion which occurred in 1826 so badly damaged the factory that it was not rebuilt.

In 1837, the industrial production was confined to a cotton mill, whose annual manufactures were valued at \$8,000; to two woolen mills, producing fabrics, valued at \$51,300; a palm-leaf hat factory, producing commodities valued at \$5,850, and a small scythe factory.

THE THORNDIKE COMPANY

On March 14, 1836, John S. Wright, Luther Parks and Israel Thorndike were granted an act of incorporation as the Thorndike Company for the purpose of manufacturing cotton, woolen and silk goods and machinery in the town of Palmer, with capital not exceeding \$500,000. Wright appears to have been the leading spirit in the enterprise and was probably the largest owner of the company's stock.

During the year preceding incorporation Joseph Brown began to purchase land and water privileges in and around the lower, or No. 1 Mill, at Thorndike, all of which parcels he deeded to the new corporation for \$23,000 on May 6, 1836.

He and Jacob Merrick bought other real estate and water privileges in the vicinity of what is now known as No. 2 Mill, at Thorndike, including what was commonly called the Cargill Mill privilege, where there existed a saw and grist mill and clothier's shop erected in 1797, equipped with three carding machines and one picker, and which was known as Merrick's Mills. The remains of the old dam are still to be seen just back of the Thorndike Company's present dye house. All of these later purchases were deeded to the company on May 28, 1838.

The original officers, elected in 1836, were: President, Israel Thorndike; treasurer and clerk, John S. Wright; moderator, Edward H. Robbins; directors, Abner and Luther Parks, Windsor Fay and Edmund Monroe.

The following have served as presidents of the corporation since its foundation: Elijah Loring, elected in 1840; John Stearns, in 1847; Thomas Cordis, in 1850; Charles H. Brown, in 1855; Henry Timmins, in 1858; R. H. Fiske, in 1864; E. P. Whitman, in 1865; Lyman Nichols, in 1868; Ephraim P. Whitman, in 1872; Francis J. Humphrey, in 1875;

Charles H. Fiske, in 1884; I. R. Clark, in 1916, and B. H. Dickson, Jr., in 1925.

Following the retirement of John S. Wright as treasurer and clerk, Eben Wright served in these positions from 1860 to 1868; John H. Wright, from 1868 to 1871; George F. Fabyan, from 1871 to 1876; Peter Olsen, from 1876 to 1908; P. Y. DeNormandie, from 1908 to 1926; Charles B. Nichols, from 1926 to 1928, and W. Joseph Littlefield, from 1928 to the present time.

Joseph Brown was the first agent and Jacob Merrick the second, their services covering the period from incorporation until April 1, 1860. Subsequent agents at the Thorndike plant, in the order of their service, have been R. H. Plummer, George T. Hill, Cornelius Wilson, William C. Green, Charles H. Hobbs and Charles A. Tabor.

The original dam at the lower privilege was built in 1837 and the No. 1 Mill was erected the same year, it being 175 by 50 feet and six stories high. The first product was plain white goods, sheetings and shirtings, 36 and 40 inches wide.

The present dam on this privilege was built in 1868 and the brick ell, commenced in the latter part of 1880, was completed and in operation in 1882.

The first dam on the upper privilege was constructed of logs and was erected in 1845. What is now the No. 2 Mill was built in 1846 and 1847 and was 215 by 50 feet and six stories high.

Another wooden dam succeeded the first structure in 1875, and seven years later the crest was raised twenty-three inches, greatly increasing the available water-power. The present cement dam was installed in 1917 by the Fred T. Ley Company of Springfield, at a cost of \$23,000.

The original No. 1 Mill began operations with 232 looms, and at the time the plant was dismantled in 1925 there were in continuous operation 871 looms and 32,808 spinning spindles, and the plant gave employment to about 600 hands. The manufacture of white goods was discontinued about January 1, 1850, and the production of colored goods was commenced, consisting of ticking, denims and awnings.

Thorndike Sateen Ticks have enjoyed a well deserved reputation in the market for many years.

In 1898 the four mills of the Warren Cotton Mills, at West Warren, were purchased for \$250,000 and added to the equipment of the Thorndike Company, at which time the capital stock was increased from \$450,000 to \$675,000. It is now \$1,200,000 and the corporation employs 600 operatives.

Walter B. Hall served as agent of the Warren Cotton Mills, of the Thorndike Company, until 1919, when he was succeeded by V. C. Faunce.

In 1925 the mills at Thorndike were closed and two years later Charles A. Tabor became agent of the mills in West Warren, where manufacturing activities have been concentrated. The Thorndike Company is now manufacturing tickings in its cotton division, and cotton warp fancy woollens in its woolen division, the former being the cotton goods sold through Bliss, Fabyan & Co., Inc., and the latter through Parker, Wilder & Co.

THE ADVENT OF THE MESSRS. KNOWLES

In 1888 Warren boasted of a cassimere factory, an ink and blueing plant, two edge tool factories, one being located at West Warren, a warp

mill, the Knowles Steam Pump Works, now the Warren Steam Pump Company, four plants at West Warren containing 732 looms, operated by Bliss, Fabyan & Co. and the Warren Cotton Mills, located at West Warren.

For many years Warren was famous as being the town where the Knowles pump was manufactured, and, until 1879, when the inventor of it, Lucius J. Knowles, and his partner, Simon K. Sibley, sold the assets of the concern to the George F. Blake Manufacturing Company the unit ranked as the town's most promising industry. The Blake & Knowles Pump Company was removed to Cambridge, and eventually was absorbed by the Worthington Pump & Machinery Corporation.

Mr. Knowles, as a member of the firm of Knowles & Hapgood, had manufactured spooled thread in Worcester in 1844; had produced cotton warps at Spencer in 1847, and two years later he removed to Worcester, where he began the manufacture of satinets. It was here that he devoted his attention to the development of the Knowles loom and in 1856 he was granted two patents—one for a close shed cam-jack for harness motion and the other for a separate picker for each cell in the drop-shuttle box. The next year he was granted a patent on a drop-box mechanism for operating drop-boxes by means of cranks set at the opposite extremes of their throw, and under the direction of a pattern-chain, or its equivalent.

This was the germ of the mechanism of the fancy loom, which was developed by successive stages into the loom as built by the Knowles Loom Works in Worcester in later years.

THE WARREN STEAM PUMP COMPANY

The Warren Steam Pump Company was incorporated in 1897 by former employees of the Knowles Steam Pump Company and citizens of Warren when the latter company moved to East Cambridge that year.

Starting on a small scale with capital of \$50,000, the new company established a reputation for building high-grade pumping machinery and this record has been carefully guarded through the subsequent years of expansion and development.

During the World War the entire output of the plant was required for naval and destroyer service in particular, twenty-nine of the latter type of vessel being completely outfitted with Warren pumps.

In 1926 a reorganization was effected and the business is now conducted under the name of the Warren Steam Pump Company, Inc., with authorized capital of \$450,000. From the modest start in 1897 in a small wooden building, the concern has expanded until it now occupies one of the most modern machine shops in New England, over five hundred feet in length and equipped with the latest types of machines. It employs seventy-five operatives.

Its officers are: President, Herbert K. Hallett, of Boston; treasurer, William W. Shuttleworth, of Warren; secretary, George H. F. Wass, of West Brookfield.

The company's products embrace all types of pumping machinery, including steam, power and centrifugal pumps for all kinds of service.

In January, 1929, the corporation placed in operation on the water-tank on the roof of its plant a revolving aerial beacon—the first aerial light in operation between Springfield and Worcester. Adjacent to the device is an electric sign displaying the name of the town.

The beacon projects a 4,000,000 candle-power beam which is said to be visible for a distance of ten miles, and it revolves at the rate of six times per minute. It is operated from sunset to sunrise every night, is located 125 feet above the ground, and is equipped with an automatic lamp charging device, against the large lamp burning out in the night. It complies with the specifications of the U. S. Division of Airways, and well illustrates the progressiveness of the officials of the Warren Steam Pump Company.

In 1924 the Warren Woolen Mills were incorporated, with capital of \$200,000 for the manufacture of worsteds, cassimeres, overcoatings and cloakings. The plant is equipped with twelve sets of cards, 100 broad looms, two boilers, three water-wheels, and complete dyeing and finishing departments. The concern employs 350 operatives. G. E. Huggins is president, G. I. Davenport, treasurer, and Edward F. Williams, agent.

The Ohio Carpet Company began the manufacture of automobile carpets at West Warren about five years ago. The plant is equipped with seven sets of cards, four mule spindles and thirty looms. George M. Wallace is president, Eugene H. Griffith, vice president, E. K. Salisbury, treasurer, and James E. Kane, superintendent. The corporation has capital of \$200,000 and employs upwards of two hundred operatives.

The Perkins Machine Company, with capital of \$100,000 employs fifty operatives in the manufacture of power presses. Fred Perkins is president, B. W. Perkins, secretary, and B. D. Perkins, treasurer.

SAMUEL SLATER'S ADVENT INTO WEBSTER

By 1811, cotton manufacturing had increased to such an extent in the Pawtucket Valley that Samuel Slater sought an outlet for all the yarns then being produced. He believed it would be advantageous to blaze new territory, and especially a growing farming community, since among the families of the early agriculturists were to be found those skilled in handloom production.

Thus it was that this most picturesque and venturesome of America's textile forefathers, who, in 1790, had founded a cotton spinning business at Pawtucket, R. I., which had become the first commercially successful textile mill in the United States, planted in Webster what today ranks as one of the three oldest manufacturing enterprises of its kind in the new world—S. Slater & Sons, Inc.

Its history is that of the textile business of America, both in cottons and woolens, and it is nearly as old as the story of the Republic since the first unit at Pawtucket was established soon after the United States had taken its place as an independent sovereignty among the nations of the globe. For a period of 150 years the Pawtucket and Webster units have marched along in step with the industrial, financial and social progress of the country.

For forty-five years of that period Samuel Slater remained active in the most romantic epoch of the business, and his contribution to American textile art is a remarkable series of accomplishments rarely assembled in the life of one man.

Apprenticed to Jed Strutt, an associate of the celebrated Arkwright, he mastered as a lad the inventions of the latter which so completely revolutionized the cotton spinning. Coupled with an insatiable desire to become a constructive factor in the industry, was his mechanical in-

stinct which enabled him to build practical and workable machinery under what proved to be the most adverse conditions.

Long before he had completed his service with Strutt, his vision had convinced him that his future lay in the youthful republic across the seas, where there awaited the hand of a master and an opportunist in the field of modern power machinery.

At that period cotton manufacturing in England was mainly centered in a small section of Derbyshire. Apparently an advertisement of an American society, carried in a Philadelphia newspaper, offering a reward for the invention of textile machinery that would accomplish what Arkwright had done, was the determining factor in his mind that the time was ripe to invade the virgin soil of the United States.

He dared tell nobody of his plans, and not even his mother or his brothers learned of his intention to come to America until he was on the Atlantic.

No doubt his secretiveness was prompted by the fact that the English government was guarding its industries with zealous care. The result of the Revolutionary War still angered the country. No skilled mechanic was permitted to leave England voluntarily, and no machinery could be sold abroad. A thorough search of every passenger sailing for America was made, and severe punishment was meted out to any person seeking to smuggle plans or parts of machines out of the country. But the British government had no monopoly on smuggling laws or brains, and minus drawings, models, or samples, Samuel Slater sailed for America, with his entire stock in trade finding lodgment in his mechanically-inclined brain.

HE LOCATES IN PAWTUCKET

One of his first acquaintances on this side of the water was Moses Brown, the founder of Brown University, and within a year following his coming he was operating the first American machine in which he had embodied the basic principles of the Arkwright inventions. His jennies and billies for the spinning of cotton were successful, where before practically all had failed, or did indifferent work. Within twenty years after he placed his spindles at work in Pawtucket, over one hundred cotton mills, small and large, were in operation in America, most of them fitted with machinery constructed after his models.

It was on January 18, 1790, that Samuel Slater began making his machinery in Pawtucket, and on the twentieth of the following December, he started the operation of three cards, drawing and roving, and seventy-two spindles, which were provided with power by an old fulling mill in a clothier's building, where yarns were spun for about twenty months, or until the firm of Almy, Brown & Slater had so many thousand pounds of yarn on hand that the local and vicinity weavers could not manufacture it into fabrics on the hand-loom of the period as fast as it was produced.

Early in 1793 they built a small factory in Pawtucket, which began operation on July 12, with seventy-two spindles. The first 13,000 pounds of cotton carded at Pawtucket were picked by hand. Samuel Slater sent some of his yarns to his old master, Strutt, who pronounced them as good as any that were being produced in England. They were fashioned from German cotton, longer than the present Sea Island type, and in fibre resembled silk.

Cotton sewing thread was unknown in England at that period and coming in contact with the Wilkinson family, living in Pawtucket, the women members of this group, remarkable for their mechanical ingenuity, conceived the idea of a thread which should supplant linen, and twisting the yarns turned out in the Slater mill on their spinning wheels, they manufactured the first cotton thread ever produced in the world, in 1792. Their efforts led to the formation of the thread-manufacturing firm of Wilkinson Brothers. Mr. Slater later married one of the Wilkinson daughters.

The chief market for the Slater yarns during the earlier years was Salem, then the principal American port. Later, Philadelphia took the bulk of the product, but much of it was retailed at the mill, either in skeins or in warps.

THE FOUNDING OF THE WEBSTER MILLS

When the time arrived to tap a new retail market Mr. Slater's attention was directed to the opportunities at Oxford South Gore, which village later became Webster, by Bela and Lyman Tiffany, two of his Pawtucket employees, who had observed as they rode back and forth at the end of each week to their home in Wales, the potential water-power available at Lake Chaubungagungawaug, on the road to Providence, which already was an important manufacturing center.

Visiting the locality, he was impressed, purchased a large tract of land, complete control of the water-power privilege, and, with Bela Tiffany, formed the firm of Slater & Tiffany, and erected, in 1812, a cotton factory known as the Green Mill, which was the beginning of the extensive industrial development at East Webster, and the predecessor of S. Slater & Sons, Inc.

In 1818, Mr. Slater became sole owner of the business. Three years before, with Edward Howard, an Englishman, he had built adjacent to the cotton factory, a small woolen mill for the manufacture of broadcloths, which was operated from 1815 to 1820, when it was destroyed by fire. Slater & Howard then purchased a water privilege at the South Village, erected mills, and operated the plant until 1829, when Samuel Slater acquired Howard's interest, and formed the firm of Samuel Slater & Sons, which was composed of himself and his sons, George B., John and Horatio N. Slater. The Webster woolen experiment was one of the first attempts to manufacture broadcloths in America.

PRESIDENT JACKSON VISITS MR. SLATER

During the presidency of Andrew Jackson, the chief magistrate of the United States visited Samuel Slater at Webster and an account of this interview is preserved by a contemporaneous author, who thus described the occasion:

"The present chief magistrate of the Union, in company with the vice president, waited on Mr. Slater, at his house, to thank him and congratulate him, as the representative of this great republic, as a friend and benefactor of the country, by introducing among them valuable machinery, before unknown, which has changed the whole policy of the Nation.

"In particular, he has promoted the growth of cotton at the South, and changed the whole face of New England, and thereby made the soli-

tary places literally glad. It has raised amidst rocks and barren land the most beautiful villages, teeming with joy and gladness. Forming a numerous population, not ignorant and vicious, not ragged and oppressed, but paid, fed and dressed, with the best the country affords; not suiken in profligacy and dissipation, but raised in intelligence and morals, as well as religious feeling, beyond the other parts of the States.

"When the president witnessed these scenes of honest industry, of happiness and plenty, of order and decorum, examples of sobriety and morals—he expressed the highest satisfaction. When he was told, that the man who introduced the foundation of this prosperity resided in the village, but was confined to his house by a rheumatic disorder, the consequence of his early exposure in operating his first machinery, President Jackson, with his suite, repaired to the house to pay his respects to the man who has thus benefited our common country.

"With the affability and complaisance so peculiar to General Jackson, he addressed Mr. Slater as the father of the American manufacturers, as the man who had erected the first valuable machinery, and who had spun yarn to make the first cotton-cloth and who had, by his superintendence and direction, as well as by intense personal labor, erected the first cotton mill in Rhode Island, which was first in the land of the Pilgrims. General Jackson, who had been informed of these particulars, entered into friendly conversation on the subject.

"‘I understand,’ said the President, ‘you taught us how to spin so as to rival Great Britain in our manufactures; you set all these thousands of spindles at work which I have delighted in viewing. And which have made so many happy by a lucrative employment.’

"‘Yes, sir,’ said Slater, ‘I suppose that I gave out the psalm and they have been singing to the tune ever since.’”

Not only was Samuel Slater famous as a textile genius, but he created the first Sunday school in America, having brought the idea with him from England, where before he left similar schools had been established at the mills of Strutt and Arkwright. At first they were conducted at Pawtucket, Webster, and at other cotton mills as charity schools, but subsequently they were taken over by religious societies.

Mr. Slater was also active in creating and maintaining day schools in both Pawtucket and Webster, and in some instances the teachers were paid from his private purse.

Almost to the day of his death, in 1835, Samuel Slater was active in the management of his mills, and from that time until 1888, Horatio N. Slater was in control, and developed the plants with rapidity and solidity.

Inheriting his father’s mechanical genius, he built his own looms, and made improvements to all kinds of machinery installed in the mills. He possessed an almost uncanny knowledge of fibre, especially of wool.

To rid himself of a transportation monopoly, he built and operated the Providence, Worcester and Springfield Railroad, and he expanded the Webster mills, and inaugurated the plan upon which they have operated, with slight modifications, ever since.

Upon his death, he was succeeded by his nephew and adopted son, Horatio N. Slater, Jr., who carried on the management until 1899, when the properties were taken over by trustees, under his will, he having been the sole owner following the death of his uncle.

THE OLDEST COMMISSION HOUSE IN THE UNITED STATES

The sales department of S. Slater & Sons, Inc., is the oldest commission house in the country, having begun to market the products of the Webster Mills, in 1866, when only three styles of cotton cloth were carried—jacconetts, wigans and red cross cambrics—all linings for women's wear. That year the sales included 91,433 pieces, valued at \$764,729.

At that time, and for a good many years afterward, three-fourths to seven-eighths of the company's cotton goods business was with the dry goods jobbing trade and comprised linings of various kinds. Since the beginning of this century a gradual change has taken place. Jobbers who formerly had large departments devoted to linings have abandoned them, women having ceased to use them. Many of the styles formerly made are no longer worn, and it has been necessary to diversify. At the present, probably eighty per cent of the entire business is with the "cutting up" trade. Since 1867 the number of styles of goods has increased and the growth of sales has been steady.

In 1890 Horatio N. Slater, Jr., commenced the printing of sleeve linings, with a production of 4,600 pieces. In 1891 the total had grown to 15,000 pieces and the following year to double that amount, and thereafter the development in the printing department was rapid.

From the time the company began to sell its own goods the cotton product increased from less than 100,000 pieces to more than one million pieces.

The growth of the woolen sales has been equally great. In 1866 the 15,430 pieces were sold for \$1,207,937. The product consisted of cloths, castors, doeskins, and moskows or beavers, all staple woolen goods for men. Of black cloths and doeskins the company has a good many of the same styles under the same names today. Orders of sixty years ago can be duplicated. Some goods have gone out altogether. No more castors are sold and very few beavers are marketed, kerseys having taken their place.

As far back as 1866, 9,454 pieces of cloths were sold, all black, blue, or brown, but in later years worsteds have come on the market, and owing to their superior intrinsic worth as well as wearing qualities, have partially driven out cloths. As the years went by styles manufactured of the woolen material were multiplied and there was some growth, though the sales ran around 20,000 pieces for a number of years. In 1890, of the 46,000 pieces of woolens distributed, 28,000 consisted of flannels and cheviots divided about equally. Both are now out of fashion, having been supplanted by worsted serges and fancy goods. A liberal estimate of the present demand for flannels and cheviots combined is from 1,500 to 2,000 pieces a year.

The sales of uniform cloths have maintained an equilibrium during many years, increasing only with the growth of the country. The Slater Mills furnish the uniforms for the Army and Navy and the merchant marine; for the Pullman service, and for railroad conductors and other trainmen and for porters; for hotel employees, and liveries for coachmen, chauffeurs and house servants.

Early in the present century, a dress goods department was added and there are now sold in woolen and worsteds all styles for men's and women's wear.

SOME INTERESTING FIGURES

The growth of the Slater Mills is easily seen by some comparative figures. In 1812 it was regarded as a dangerous situation to have on hand 5,000 pounds of cotton, but in 1866, a little more than fifty years later the Webster mills manufactured and sold 91,433 pieces of cotton goods, and 15,430 pieces of woolen fabrics.

A half century later the company produced and sold 1,250,000 pieces of cotton goods and 90,000 pieces of woolens and worsteds.

Contrasted with sales during this century running from 1,250,000 to 1,750,000 pieces of cotton goods, and from 90,000 to 125,000 pieces of woolen and worsted goods, the growth of the concern is readily apparent.

At the request of the U. S. Government, the Slater Mills stopped all production in civilian products at the outbreak of the World War and devoted their entire productive capacity to the Army, Navy and Red Cross needs, turning out upwards of 5,000,000 yards of cotton goods, 3,000,000 yards of woolen products, and hundreds of thousands of yards of goods for special government purposes, in 1917 and 1918. From their beginnings the plants have constituted the indices of prosperity in Webster.

Capitalized for \$2,200,000, the company employs 950 operatives. The cotton division is equipped with 81,360 spindles and 2,082 looms, and the woolen units with 6,600 worsted spindles and 395 broad looms, while the converting plant has five printing machines. The concern was incorporated in 1927 as Slater Mills, Inc., and later as S. Slater & Sons, Inc. H. N. Slater is president, W. P. Wright, vice president, E. L. Moore, treasurer, and G. A. Hilton, secretary. The present day operations include the weaving, bleaching, dyeing and printing of cotton fabrics.

The Slater Company, Inc., was incorporated in 1927, with capital of \$800,000 and produces cotton and rayon fabrics. The plant is equipped with fourteen boilers and 450 hands are employed. W. T. Joyce is president and general manager, H. N. Slater, vice president and H. V. McClennan, treasurer and secretary.

THE LOCAL SITUATION IN 1837

In 1837, Webster possessed three cotton mills, equipped with 6,088 spindles, and that year there were manufactured 1,155,535 yards of cloth, valued at \$103,427, the plants employing 163 hands. There were also two woolen mills, manufacturing 60,000 yards of cloth, valued at \$180,000, and affording employment to ninety-five hands, and a thread mill, producing 42,000 pounds of thread annually, valued at \$26,000, and employing thirty hands.

The boot and shoe industry of the town dates to about 1843 when Henry E. Bugbee, of Natick, started manufacture, although B. A. Corbin began operations in the adjoining town of Dudley, as early as 1837, removing to Worcester, in 1854, and coming to Webster later where he formed the partnership of B. A. Corbin & Son. The Webster and Marlboro factories of the B. A. Corbin & Son Company, which has capital of \$650,000 today, employ 1,500 operatives and the concern is capitalized for \$650,000, only men's and boys' shoes being produced. Henry G. Powning is president, W. S. Field, secretary and Henry G. Lapham, treasurer.

The Franklin Shoe Company, a subsidiary of the Corbin concern, oper-

ates a unit in Webster, as well as one in Marlboro. It has capital of \$50,000 and J. H. Patterson, Jr., is president; H. G. Powning, vice president, H. G. Lapham, treasurer, and H. F. Bamberg, clerk.

A NEW YORKER COMES TO WEBSTER TO MANUFACTURE SHOES

The firm of A. J. Bates & Co., was organized in 1886 by A. J. Bates, who devoted his energies for forty-eight years to the manufacturing and selling of shoes.

In March, 1886, A. J. Bates & Co., of New York City, bought, from the Webster Five Cents Savings Bank, a small unoccupied structure at the head of Mechanic Street, in Webster, known as the Power Building, with three acres of surrounding ground. This New York City firm was a large buyer of shoes, and the Webster purchase was made solely for the purpose of manufacturing one line of shoes formerly made for them by E. & A. H. Batchelder Company of North Brookfield.

The venture was a success from the start, and soon an addition to the original small building was made, and shortly after another. In 1893 the facilities were found to be wholly inadequate and upon the retirement of Humphrey & Burnham, from the shoe manufacturing field, the building occupied by that firm was purchased and annexed to the main factory at the Bates plant. A year later a substantial addition was made, and practically every year since new wings and more stories have been built. Today, the original building is used as one of the minor storehouses of the factory. In the summer of 1905 a large three story administration building was erected.

The factory was originally managed by J. B. Burnham, formerly of Humphrey & Burnham, but a few months afterward he was succeeded by Edgar A. Bates, son of the founder.

In 1906 a corporation was formed and the name of A. J. Bates & Company was changed to the A. J. Bates Company. This corporation was composed of A. J. Bates, president, E. A. Bates, treasurer, F. I. Sears, general manager, and W. A. Taylor, secretary.

Upon the death of A. J. Bates in 1916, E. A. Bates became president and treasurer, F. I. Sears, vice president, and Edgar A. Craver, a grandson of A. J. Bates, secretary.

In 1925, E. A. Bates resigned as president, and the company was again reorganized, with F. I. Sears as president and treasurer, F. A. Brewster, as vice president and F. A. Craver, as secretary, the latter being a grandson of A. J. Bates. In 1929 the A. J. Bates Company was liquidated and was succeeded by the Bates Shoe Company, the officers being the same as those given above. The new corporation has capital of \$700,000 and employs 600 operatives.

Originally all goods were sold in New York City, but for many years the Bates Shoe has been marketed throughout the entire country. Twice a year the force of retail salesmen starts from the factory with samples of every style manufactured, and the Bates product is shown from Maine to California, and from Oregon to Florida.

THE PLANTS OF THE AMERICAN WOOLEN COMPANY

In 1860 John Chase erected the original unit of the Chase Mills, later admitting his son, Frederick F. Chase to partnership in the firm of John Chase & Sons. In 1878 and again in 1882 large additions were made to

the original plant, which became a unit of the American Woolen Company when that corporation was organized. The mill is equipped with 9,900 spindles, 167 looms, seventeen sets of cards, a dyeing department, six boilers and two water-wheels, and employs 600 operatives.

The Webster Mill, the other local unit of the American Woolen Company has twenty-four sets of cards, 201 broad and six narrow looms, and 21,220 spindles.

The Chase Mills manufacture fancy cassimeres and worsteds and the Webster Mill produces men's wear woolens.

OTHER INDUSTRIAL ENTERPRISES OF THE TOWN

The Packard Mills, Inc., were incorporated in 1921 with capital of \$75,000, and manufactures women's wear woolens. The plant is equipped with eight sets of cards, thirty-three looms, dyeing and finishing departments, and one boiler, and employs 100 hands. An auxiliary plant is operated at Ashland, N. H. L. W. Packard is president, W. P. Cohen, vice president, and R. K. Hubbard, treasurer, secretary and agent.

In 1923 the Maanexit Spinning Company, was incorporated, with capital of \$96,000 and produces merino and wool yarns, and employs eighty operatives. The plant has eight sets of cards, 5,392 woolen spindles, a picker and a boiler. S. M. Anderton is president, H. E. Kisro, secretary, R. J. Anderton, treasurer, and Clarence E. Fletcher, superintendent.

The Chilton Company was incorporated in 1924, with capital of \$25,000, and produces woolen yarns. The plant has seventeen sets of cards, 5,532 worsted spindles, a dyeing department, equipped with six dyeing machines, and one boiler and employs 200 operatives. Sherman L. Whipple, Jr., is president and treasurer of the concern, which operates a branch unit in Northboro.

The Puritan Mill of the Intervale Mills, Inc., of Dudley, which manufactured men's wear suitings, and which were equipped with nine sets of cards, sixty-one looms, 4,674 spindles, three pickers and two boilers, were acquired in 1929 by a group of Boston, Worcester and Webster men, to produce silk products, operating on a three shift basis and employing 300 hands. Crompton & Knowles looms were installed. Frank A. Raymond, of Webster, is at the head of the group.

In 1927 the Waterhouse Company moved to Webster from Rhode Island. An assembling room for motor bus bodies was built that year.

The complete plant cost \$40,000 and is 100 by 70 feet in dimensions, and of cement construction. It affords employment to about fifty persons. C. L. Waterhouse is president, and S. Robert Dunham, Jr., is treasurer of the corporation.

The United Optical Company is one of the town's recent industries, and soon after operations were started it entered the European field, which necessitated materially increased facilities and an increased corps of employees. Fifty hands are now steadily employed. The corporation has capital of \$35,000. William F. McLean is president, and John E. Coggin, secretary and treasurer.

The Middlesex Casket Company employs forty operatives in the manufacture of caskets, the corporation having capital of \$200,000. Stanislaus A. Nowakowski is president, Charles B. Robba, secretary, and Anthony A. Cyran, treasurer.

The Racicot-Richard Cutlery Company, Inc., with capital of \$10,000

employs thirty hands in the manufacture of cutlery. Arthur H. Racicot is president and treasurer, and A. N. Racicot, is secretary.

The Winsor Manufacturing Corporation employs fifty hands in the manufacture of handkerchiefs and pillow cases. M. Miller is president, Wm. J. Young, treasurer and Wm. H. Young, assistant treasurer.

WESTBORO—THE BIRTHPLACE OF ELI WHITNEY, INVENTOR OF
THE COTTON GIN

While Westboro had a nail factory in operation as early as 1776, the chief claim of the town to industrial fame is derived from the fact that it was here that Eli Whitney, the inventor of the cotton gin, was born. In November, 1793, having turned his attention to the construction of a machine for cleaning cotton, he completed his first working model of the saw gin. The cylinder was only two feet two inches in length and six in diameter, and was turned by hand by one person. It was capable of cleaning fifty pounds (after separation) of green seed cotton in a day.

Whitney had no knowledge of textile production, but he had been adept in "rigging up" labor-saving contrivances in his own home. While serving as a tutor, on a southern plantation, his attention was directed to the laborious effort involved in cleaning cotton, and out of an off-hand suggestion, laughingly offered, that he make a machine to do the work, he evolved the cotton gin, embodying the principle of substituting wires for the fingers of the negro mammies in clawing the cotton fibers away from the seeds.

The United States was then an agricultural country, and it is not surprising that its first great contribution to the textile industry should pertain to the raising of the great staple upon which its very life and existence depended, nor strange that to a son of Massachusetts, of proverbial Yankee genius, should have fallen the honor for the invention.

Mrs. Greene, the generous patron of the invention and the first instigator of the device, eager to extend the knowledge of a contribution so important to the nation, whose markets were then glutted with all the ordinary staples, while the negroes of the South were without employment, invited to her home gentlemen from different parts of Connecticut. Conducting them to a temporary building erected for the machine, they saw, with delight and astonishment, that more cotton could be separated in one day by a single hand, than could be done by the ordinary mode in many months.

The success of the cotton gin being no longer doubtful, Phineas Miller, a Yale graduate and a Connecticut man, with the husband of Mrs. Greene, entered into a co-partnership with Whitney for the purpose of maturing and patenting the machine, the expenses to be borne by Mr. Miller. The articles provided "that the profits and emoluments to be derived from patenting, making, vending, and working the same, should be mutually and equally shared between them."

They immediately commenced business, and Mr. Whitney went to Connecticut to complete the machine, obtain a patent, and manufacture and ship to Georgia, as many machines as would supply the demand. Application for a patent was made to Thomas Jefferson, then Secretary of State, who promised to grant it so soon as the model was lodged in the patent office. An affidavit of the invention was also filed, with a notary public

of the city of New Haven. But the patent was not issued until the following March. Before this, and ere the inventor had reached Connecticut, encroachments upon the rights of the promoters had commenced in consequence of the imprudent exhibition of the machine. Knowledge of the invention had spread far and wide throughout the state, and multitudes came to see it. This privilege being properly denied until a patent could be secured, a group, unrestrained by law or justice, broke into the building at night and carried off the machine. A number of gins, with slight evasive deviations from the original, were constructed and put in operation before the patent was obtained. A series of wholesale depredations upon the rights of the inventor, of which there are few such examples on record, was begun, and received little check either from the gratitude or the moral sense of the community. The unfortunate arrangement of Whitney and Miller, to erect gins throughout the Southern cotton fields, and engross the business of ginning for a toll of one-third, instead of selling the machines and patent rights, stimulated the spirit of infringement. The operation was too extensive and complicated for the financial means of the proprietors, and was unsatisfactory to the planters. As a monopoly, it furnished a pretext and a market for an illegal manufacturer of the machines, which ultimately involved the patentees in more than sixty expensive and annoying lawsuits, and compelled Whitney, early to abandon all hopes of compensation for his invaluable discovery, especially in Georgia, where his patent was immediately invaded, and he was forced to find a more profitable exercise of his talents in another field. He afterward met, however, a more generous appreciation of the value of his invention in other states.

South Carolina paid him \$50,000 and threw the invention open to the use of its planters, while smaller amounts accrued to him from taxes granted in North Carolina and Tennessee, but outside of these three states, Whitney received nothing. The culture of cotton soon became general throughout the South and estates of enormous value were created in South Carolina.

In 1795, 8,000,000 pounds of cotton were marketed in the South, 6,000,000 pounds being exported, while six years later the product had risen to 48,000,000 pounds, of which 20,000,000 pounds were exported.

Whitney's invention gave an immense impulse to the cultivation of cotton and conferred upon the plantation states of the South a boon that was impossible of computation in money.

In economic value the cotton gin ranks with the inventions of Arkwright and Fulton, enabling the planter to clean for market by the labor of a single slave, a thousand pounds of cotton, in lieu of the five or six pounds by hand, or twenty-five by the roller gin.

The manufacture of boots and shoes and straw bonnets distinguished Westboro for many years, the footwear producers of the earlier years being J. B. Kimball & Son, Messrs. Gould & Walker, and George B. Brigham & Sons.

Bates, Parker & Son were the first to manufacture straw goods by machinery and in the decade 1880-1890, the H. O. Bennett Company employed 900 workers in the production of straw hats and bonnets.

Burnap, Forbes & Co., later Forbes & Fisher, and still later D. W. Forbes & Son, were prominent in the manufacture of sleighs.

LOCAL INDUSTRIES OF TODAY

J. S. Mason & Sons employs 100 operatives in the production of tapes, bindings, and narrow fabrics, the plant being equipped with 120 looms.

J. S. Mason is president, J. B. Mason, vice president, and C. S. Mason, treasurer, secretary and sales manager.

The Westboro Underwear Company, established in 1897, employs fifty operatives in the manufacture of women's underwear and cotton crepe, and has its Boston office, at 52 Chauncy Street.

The concern is a partnership made up of Melvin H. and Irving E. Walker and Louis A. Fairbanks.

Women's straw and felt hats were produced in the town for many years by the Westboro Hat Company, which became the town's largest employer of labor, upwards of 250 operatives having been carried on the payrolls, prior to the liquidation of the concern, in 1928. The following year the plant and assets were acquired by George B. Burnett & Sons, of Amherst, and was reopened for the manufacture of men's straw hats. E. J. Sears is president of the concern.

The Tufts Machine Company, owned by James K. Tufts, is engaged in the production of machinery.

James M. Hassall, operating as Hassall & Co., manufactures curtains.

The Gill Screw Associates, Inc., produces screws, Charles R. Scott being president and treasurer and Philip R. Scott, secretary of the corporation, which has capital of \$10,000.

The Charles E. Fogg Company whose headquarters are at 8 Atlantic Avenue, Boston, operates its factory where bedding is manufactured in Westboro. The corporation has capital of \$100,000, and employs seventy-five operatives. C. E. Fogg is president and A. M. Callahan is treasurer and secretary.

The James R. Cooper Company, Inc., which removed to Westboro, in 1912, and which became incorporated in 1921, with capital of \$50,000, is engaged in the tanning and finishing of sheepskin leather, and employs twenty-five operatives. James R. Cooper is president and treasurer and H. Porter Dorr, secretary.

Wooden boxes are manufactured by the Bartlett Box & Lumber Company, which has capital of \$15,000 and employs thirty-five operatives. F. V. Bartlett is president, and C. W. Bartlett, treasurer and secretary. The concern is the successor of C. Whitney & Co., which began business in 1883, as box manufacturers and lumber dealers. The latter business has been carried on under the name of the Westboro Lumber Company since 1902, when the Bartlett Box & Lumber Company was formed.

The Bay State Abrasive Products Company was established in 1922, with capital of \$25,000, since increased to \$100,000, to manufacture grinding wheels, refractories and abrasive bricks. O. S. Buckner is president and L. M. Krull, treasurer. The concern employs sixty operatives.

WESTBORO INVENTORS STILL ACTIVE

In 1922, Joseph N. Bethel and Sidney Player organized the Bethel-Player Company which, five years later, was reorganized as Bethel-Player & Co., Inc. The first product of the firm was a vertical cylindrical lapping machine which was the first commercial lapping machine ever put on the market. The organization enjoyed a healthy growth from the

beginning and products increased from one type of lapping machine to thirteen varieties, many of which are covered by patents and patents pending.

In 1928 the Norton Company, of Worcester, acquired the entire capital stock and good will of the concern and the products are now being made at the Worcester plant.

The crankshaft lapping machines, cylindrical and flat lapping machines, hole and cylinder lapping machines, and tool room bench laps, performing operations that usually follow the grinding operation made the line a logical addition to the Norton company's precision grinding machines.

These lapping machines find a market in manufacturing plants producing automobiles, aero engines, electrical apparatus, calculators, fine tools and gauges, pneumatic tools, high pressure pumps, roller bearings and optical goods. In fact, they are essential to a high standard of accuracy in all precision manufacturing.

Due to the present-day demand for transportation and production machinery of high speed and extreme precision, a wide field has been developed for lapping machinery as an adjunct to grinding and once again Massachusetts inventors and industrialists have demonstrated the fact that they are thoroughly alive to the up-to-the-minute demands of the machine world, and well in advance of the procession.

The Whiting Body Company began the manufacture of automobile trailers, in 1927, and has installed new machinery to take care of many orders, some of which were placed by state highway departments.

In 1929 the Montan Company erected a plant, on the border of Hockomocko Pond, and adjacent to the B. & A. tracks where it treats wooden poles and ties with a chemical that prevents decay. Even before its completion, 150,000 ties were in its yard awaiting treatment. Fifty men are employed at the plant, which is the only one of its kind in New England.

The Coombs Company, owned by L. B. Coombs, is engaged in the local manufacture of paints.

The Westboro Weaving Company, with capital of \$150,000, employs 100 operatives in the manufacture of narrow textile fabrics. J. Graham Wright is president, Malcolm D. McMeekan, vice president, Conrad Offeney, treasurer, and J. R. Fridlington, secretary. The company's New York City office is at 108 Franklin Street.

Marcus Mason & Co., Inc., whose main headquarters are at 201 Devonshire Street, Boston, manufactures plantation machinery at its plant in Westboro, where sixty hands are employed. James Guiler is president and treasurer and M. G. Backus, clerk. The corporation has capital of \$100,000.

THE MANUFACTURES OF WEST BROOKFIELD

Forty-five years ago West Brookfield was the seat of the shoe factories of McIntosh & Co., M. J. Savage & Co., George H. Fales, J. T. Wood & Co., and Allen & Makepeace, as well as a corset factory. The Puritan Braid Company was engaged in later years in the manufacture of shoe laces, and the F. H. Sancey Shoe Company operated a plant until recently.

Harold Chesson & Son, employing thirty hands, is engaged in the manufacture of leather novelties. The partners are Harold and H. Roy

Chesson. They also own and operate the Standard Corset Company of Holyoke.

In 1928, the Seneca Wire Manufacturing Company, of Fostoria, Ohio, which had previously purchased the assets of the Wheeldon Wire Company erected three additional buildings to its plant to provide for a new annealing department, which increased its capacity five fold and a new acid storage unit, and a new lime structure. A four-ton electric hoisting crane was also added to the equipment, together with a heavy ten-block rod frame, several new cold rolling mills and take-ups, a number of new galvanizing and tinning take-ups, as well as new twisting and straightening machines and additional annealing furnaces and equipment. The production of special twisted and straightened wires and many special soft wires for special requirements are being produced, in addition to specializing in high carbon wires manufactured from both domestic and Swedish steels. The concern still operates under the corporate name of the Wheeldon Wire Company, of which Charles H. Sparrell is treasurer.

The New England Manufacturing Company of Worcester maintains a branch plant in West Brookfield.

The B. & R. Dress Company, owned by Benjamin Side, manufactures women's dresses and employs thirty hands. The Gardner Table Manufacturing Company, of Gardner, operates a branch plant in West Brookfield, and the Gavitt Manufacturing Company, which manufactures telephone cords and insulated wire at its plant in Brookfield, has its main headquarters in West Brookfield.

West Boylston's only industry since the removal of the West Boylston Manufacturing Company to Easthampton, at the time the Wachusett dam and reservoir were constructed, is the pipe organ factory of George W. Reed & Son, now owned by Earl W. Reed.

WESTMINSTER—THE CRACKER TOWN

About 1793, iron works were erected at Westminster, at which period there also flourished there a cut nail manufactory and a trip hammer.

For almost a century Westminster has been famed for its crackers. It was in 1845 that Alfred Wyman erected in the center of the town his plant for the baking of bread in quantity, and for the manufacture of what in later years became known to the New England household as the Westminster cracker. E. L. Burnham & Sons succeeded to the Wyman business and today Dawley & Shepard annually market 30,000 barrels of the products. Twenty-five hands are employed at the plant, which is on the Mohawk Trail route. George L. Dawley and Herman A. Shepard constitute the partnership.

Charles Coolidge, the grandfather of Hon. Marcus A. Coolidge, of Fitchburg, was the pioneer manufacturer of chairs, in Westminster.

BAXTER D. WHITNEY & SON, INC.

In 1830, at the age of fourteen years, Baxter D. Whitney, son of Amasa Whitney, one of the industrial pioneers of the town of Winchendon, was sent to aid Messrs. White & Boyde, of Worcester, in building some looms for the senior Whitney, and upon the return of the boy he constructed a "gig" for wrapping cloth, making the wood patterns unaided, and afterward finishing all the parts of the machine.

Two years later, Amasa Whitney, despatched Baxter to a factory at



BAXTER D. WHITNEY & SON, INC., WINCHENDON

Plympton where he had learned that a satinet fabric was being produced in which the cotton threads on the back were more adequately covered by the filling than was possible in the senior Whitney's factory, and upon the return of the fifteen-years-old boy he made changes in his father's looms which produced the desired result.

Shortly after, having observed a warping and dressing machine, at Fitchburg, he built one on the same model for his father. At eighteen years of age he was in charge of the building and repair of machinery in the plant of the Winchendon Manufacturing Company which had succeeded to his father's business. In 1837 when this concern suspended operations, Baxter D. Whitney built a modest building and there began the manufacture of wood-working machinery. It was here that he made the cloth stretching machine which he and Geo. W. Lawton had patented while working for the Winchendon Manufacturing Company. Then followed the invention and production of machinery for making clothes-pins; pail and tub-making machines, including one for cutting the pail-ears, and other machines for the manufacture of chairs and woodenware. His first patent on wood-working machinery was issued August 11, 1857, on a smoothing machine, which surfaced and finished better and more rapidly than by hand hard wood lumber that had previously been run through a wood-planer. On August 7, 1860, he was granted a patent on a gauge-lathe, which turned and finished ornamental rails of any desired contour in one operation.

Then came the patent on his rotary-head cylinder planer—the first of its kind, and an invention that contributed more than any other device to the advancement of all wood-working processes.

On April 9, 1867, he was given a patent on a machine for grinding the surface of cylinder or barrel-saws, and in May, 1872, one was awarded him on a stave-sawing machine, and on the same date, and on May 14, 1872, April 8, 1873, and July 13, 1875, patents covering various improvements on band-saws were awarded him.

In 1867 he exhibited at the Paris Exposition his cylinder planing machine, a saw-bench for the use of pattern makers, his gauge-lathe and his wood-smoothing machine, receiving a silver medal, and six years later, at Vienna, he showed the four above mentioned devices, a band-sawing machine, and a complete set of machinery for making pails. Prior to the Philadelphia Centennial of 1876, Mr. Whitney was the holder of fourteen gold, bronze and silver medals awarded his machines at various world's fairs.

Altogether he was the recipient of not less than twenty-two patents on designs and improvements on planing, stave, shaping, boring, and wood scraping machines, many of the products such as the scraping, the single and double-surface planers, the barrel stave-sawing, the two-spindle-up-right-shaping, the back-knife-gauge-lathe, were revolutionary as well as intricate mechanical devices.

Closely identified with the business for nearly seventy years, Mr. Whitney died, in 1915, at the age of ninety-nine.

Baxter D. Whitney & Son, Inc., specializes in the manufacture of direct motor driven planers, shapers, or variety moulders, saw benches, bit mortisers, scraping machines, back knife gauge lathes, all these devices being designed for direct motor drives, and barrel, tool and pail stave sawing machines.

The company's products are used by furniture, chair, piano, and automobile body manufacturers, and by all industries employing high-class cabinet making process, as well as by producers of staves.

The Winchendon concern was a pioneer in the field of direct motor driven wood-working machinery, building the first single planer operated by direct motor drive, in 1911, and following that product a year later with the first double planer with motors coupled to the cutter heads.

In 1916 the company designed and perfected the first double spindle shaper having motors mounted on the spindles in place of pulleys.

Since that year the first motor driven saw bench, with tilting arbor, the first direct motor driven single saw boring machine, the first direct motor driven saw tenoner and the first motor driven horizontal bit mortiser have been added to the company's line.

The products are marketed through selling agents located in the principal cities of the United States, as well as Europe and Australia.

The Whitney plant covers four acres, and has manufacturing space of more than 150,000 square feet. It employs 275 skilled mechanics.

For almost ninety years the company has been under the ownership and management of the Whitney family. William M. Whitney, son of Baxter D. Whitney, is president and treasurer of the company at the present time. Frank C. Smith, Jr., is clerk and F. F. Davis, assistant treasurer. The corporation has capital of \$1,185,000.

THE E. MURDOCK COMPANY

In 1831, Col. William Murdock established the first machine shop set up in Winchendon, and began the manufacture of cotton and woolen mill spools.

Many years ago Winchendon achieved the sobriquet of "The Home of Woodenware Manufacture," due to the fact that for approximately a century that type of production was confined almost exclusively to that town.

Elisha Murdock began the manufacture of tubs and pails by machinery invented by his brother, Capt. Ephraim Murdock, and the first factory, located upon the site of the present establishment of E. Murdock Company was burned in 1840, but an enlarged plant was built immediately thereafter, which was destroyed by fire in 1895. A new factory was erected and the variety of products enlarged. From the original structure forty feet square has grown the present plant, which, if concentrated in one building would present a structure over 700 feet long by 40 feet in width. Under the administration of Elisha M. Whitney, president and treasurer of the corporation, it has grown until it employs 225 operatives, and is capitalized for \$400,000. William M. Whitney is vice president and M. R. Heywood is secretary.

In 1929 the E. Murdock Company, the Keene Woodworking Company, of Keene, N. H., and the West Swanzey, N. H. plant, of the New England Box Company, were merged to form the New England Woodenware Corporation, but the Winchendon unit will still be operated and managed by the same officers as heretofore.

N. D. WHITE & SONS

In 1843 Nelson D. White, eldest son of Joseph White, organized a corporation and purchased a mill, at Springdale, operating the plant under the name of the Nelson Mills, and managing it under contract. In 1854

a brick factory which had been erected by Baxter D. Whitney was hired and occupied by Mr. White. The same year the Springdale plant was burned, but Mr. White secured subscriptions for its rebuilding, and when it was opened in 1857 he managed it for the promoters until 1863 when he acquired all of the outstanding stock and became the sole owner of the plant.

Both mills which he then directed were devoted to the manufacture of sheetings, until 1870, when Mr. White changed the product to colored goods. By an improvement devised by him, the dyeing was accomplished by passing the whole warp continuously and repeatedly through the vat,—a process upon which he secured a patent.

The company, now known as Nelson D. White & Sons, Inc., operates the Nelson and Glenallen plants, equipped with 17,000 spindles, 104 cards, 200 looms, complete dyeing and finishing departments, seven boilers and four water-wheels.

The corporation has capital of \$1,000,000 and makes a specialty of indigo blue denims.

Descendants of Joseph White are today operating textile establishments in Massachusetts, and New Hampshire. Charles D. White is president, Joseph N. White, Jr., secretary and treasurer, and Nelson D. White, general manager, of N. D. White & Sons, Inc., which employs 250 operatives.

THE GOODSPEED MACHINE COMPANY

1849, Messrs. Robinson & Goodspeed began the manufacture of wood-working machinery in the town, the firm becoming Goodspeed & Wyman two years later and since 1878 the Goodspeed Machine Company. The concern is capitalized for \$100,000 and employs thirty-five operatives.

William H. Brown is president, and John J. Witt, vice president and treasurer.

Today, the concern is manufacturing high-grade modern wood-working machines, and specializing in shapers, buzz planers, turning-lathes, automatic back-knife gauge lathes, etc., used in the making of tubs, pails, spools, bobbins, heels and other wood products.

THE TOY TOWN OF THE WORLD

When, a few years ago, a little miss boasted to her city cousins, with whom she was visiting, that she lived in the place that held the honor of being the largest toy manufacturing town in all the world, she met with the superior retort, "I guess you mean in Massachusetts, don't you? Of course it can't be the largest in the world." But the little girl was right, however, for Winchendon still boasts the distinction of producing more toys than are made anywhere else on the globe, Nuremburg, Germany, notwithstanding,

From the earliest times the thrifty denizens of Winchendon have been turning wood into money. In fact, it might truthfully be said that it has become a fetish with them, for, as early as 1782, when paper money was useless on account of the Revolution, the settlers of Winchendon used shingles as currency. Then and there they originated the idea of transforming their local supply of raw materials into cash.

And they have never deviated from that policy. More wooden tubs and pails are manufactured in the town today than in any other municipal-

ity in the United States, and even before the production of toys reached its high rank, woodenware constituted the chief industry of the town.

It was here, too, that the first cylinder saw was perfected by William R. Hyde and here also that William Murdock invented the lathe.

As early as 1877 Winchendon began its march to become the "Toy Town of the World."

Small boys and girls hugging engines and dolls to their hearts, beneath the Christmas trees of America, still sees visions of a white-bearded old soul surrounded by assorted toys, tucked upon a little sled away off at the top of the world. But the day has gone when his assembling plant was located beyond the shores of the United States.

The toy shop of Santa Claus once was in Switzerland, Germany, Japan and Italy, but now it is in this country.

Ten years ago eighty-five per cent of the toys sold in the United States were imported.

Today eighty-five per cent of them are made at home. When the German supply was cut off during the World War, toy factories in Massachusetts expanded, and many new concerns came into being. From 290 in 1913, throughout the country the total rose to 541 in 1918 and since that time hundreds of others have been formed. It is estimated that during the past five years the American production of toys has doubled in value and that at the present time there are being manufactured in the United States toys of all kinds, whose selling value is in excess of \$200,000,000.

It has been said that if all traces of the present civilization were to be wiped out except the contents of a toy shop, posterity would still have a fair idea as to how this generation lived. There would be little houses with a bath to every room and skyscraper skeletons with girders of steel. There would be hobby horses, but many more automobiles; there would be airplanes and electric railways, little phonographs and typewriters and printing presses. The toy shop reproduces the home, the office and the shop, and does it with exactness reduced to scale.

The daughter's doll vacuum cleaner is just like mother's, and the son's tiny speed boat of mahogany with brass trimmings is just like the real one that takes the family on Sunday outings. A sprinkler wagon must have a tank that holds water and a tap that lets it out, and the hook-and-ladder must have rigging in working condition.

MORTON E. CONVERSE & SON COMPANY

Morton E. Converse & Son Company was founded by two natives of New Hampshire, both richly endowed with energy, industry and ingenuity, the ruling characteristics of the genuine Yankee, and the advent into Winchendon of these two manufacturers—Morton E. Converse and Alfred C. Mason—resulted in the establishment there of the Nuremburg of America.

In 1877 Messrs. Converse and Mason began making toys in a small way, with twelve employes, in the village of Waterville, subsequently removing to the site where the Converse factory now stands.

The products were fabricated from designs made by Mr. Converse and manufactured by machinery patented by him.

In 1883 he purchased Mr. Mason's interest in the concern, removed the plant to the idle Monadnock Mills, and changed the name to the Con-

verse Toy and Woodenware Company. Two years later it became Morton E. Converse & Co.

The plant was greatly extended, and today upwards of six acres of floor space are occupied. The company absorbed the former local New England Lock & Hinge Company which also was engaged in producing toys.

The Morton E. Converse & Son Company has capital of \$200,000 and employs upwards of 300 operatives.

Atherton D. Converse, son of one of the founders, is treasurer and W. H. Hezlett, is president and secretary.

WM. BROWN SONS

In 1878, William Brown and his two sons, Arthur L. and William H. began the manufacture of woodenware, in Bullardville, their plant, which was burned in 1890, being immediately rebuilt on an enlarged scale. In 1898, a new factory site was purchased in Winchendon and the company's many buildings cover the greater part of forty acres.

The corporation, now known as The Wm. Brown & Sons Company has capital of \$300,000, and employs 125 men in the production of woodenware.

Charles T. Brown is president, and Julia R. Roebuck, treasurer and secretary.

M. H. PARKS & COMPANY

From 1892 to 1926 the manufacture of reed furniture was carried on by M. B. Bartlett & Co., Carter & Co., and finally by Carter & Campbell, and in 1894 M. H. Parks & Co., began the manufacture of barrel covers at a plant, on Millers River, which, about 1900, was removed to Waterville, where the production of spools and bobbins was added, the concern having capital of \$100,000 and employing fifty operatives.

M. H. Parks is president and treasurer, A. E. Parks, vice president, and K. M. Parks, clerk.

THE ALASKA FREEZER COMPANY, INC.

In 1902 the Alaska Freezer Company, Inc., began business with a dozen employees and in the intervening years has become one of the largest producers of metal ice-cream freezers in the country, maintaining in its plant a large foundry, and galvanizing and turning departments, where both the hot process and electric galvanizing baths are operated. Its products are shipped to all parts of the civilized world, the export business being particularly extensive. Capitalized for \$320,000 it employs 125 operatives.

In 1914 it added to its line of Alaska freezers by purchasing from the Dana Manufacturing Company, of Cincinnati, the latter's patents, trade marks, good will, and patterns for the well known Peerless line of hand and power freezers.

Still another addition was made in October, 1927, by the purchase of all the patents, trade marks, good will, dies, etc., of the Auto Vacuum Freezer and its present line is the most complete in the world and includes household electric freezers, hotel power freezers up to the 40-quart size, Alaska Grey Goose, Alaska North Star, Peerless Iceland, Peerless, Frezo, and Cottage Special wood tub hand freezers, Auto Vacuum freezers, low priced metal freezers, ice crushers, chippers and accessories.

The company has a well equipped foundry and makes a specialty of furnishing high-grade, close grained, easily machined, soft grey iron castings. Its foundry customers include some of the highest grade tool and hardware manufacturers in the country.

William H. Brown is president; J. W. Meyer, Jr., secretary; and Warren H. Prichard, treasurer and general manager.

THE MASON & PARKER MANUFACTURING COMPANY

When some of the curiously inclined diagnosticians attempt to find out what particular disease Massachusetts industries are suffering from they might apply their vocal stethoscopes to the Mason & Parker Manufacturing Company, a voluntary trust, which grew out of the business originally established in Winchendon, shortly after the Civil War, by Orlando Mason and Homer N. Parker, and which, in 1903, was taken over by the National Novelty Corporation, a unit that was dissolved through a receivership, in 1912.

Some of the present owners, believing that an opportunity existed to serve the public through the manufacture of toys and novelties, took over the plant, in 1912, and as an indication of the success achieved it is interesting to note that while the Mason & Parker concern paid taxes of \$313 to the town of Winchendon, in 1914, when it settled its municipal tax bill of 1927, it drew a check for \$4,121, an increase of 131% in a fourteen-year period.

The confidence of its executives in the future of the toy and novelty business it has developed in less than a decade and a half was convincingly evidenced in 1928 when the concern purchased the lower mill of the Fiskdale Manufacturing Company, in Fiskdale, in order that it might gain an excellent water privilege, as well as a good set of buildings and take advantage of a splendid available labor supply. At that time it controlled two water-power privileges, one at its main plant, in Winchendon, generating 200-horse-power, and another of the same horse-power, a modern hydro-electric plant further down the stream, and connected with the main factory by high tension wires.

Every working day two carloads of toy pianos, juvenile tool chests, children's blackboards, dolls' trunks, and other educational toys, are turned out at the plant, the complete line embracing approximately 250 distinct types and sizes of toys.

The concern operates its own timber lands, employs 300 hands, has storage space sufficient to house an entire year's production, and is capitalized for \$182,500.

In 1929, the company purchased the mills of the American Woolen Company, at South Royalston, consisting of 66,000 square feet of manufacturing floor space, and all water rights, and tenements, and the plant is now used in the expansion of the Mason & Parker business. The Winchendon and South Royalston factories are operated entirely by water-power furnished by Millers River, the water-wheels at the two units generating in all over 1,000 horse-power.

The same year the corporation disposed of its Fiskdale property to the Sturbridge Finishing Company as the latter concern desired to expand its local facilities, and to augment its water-power facilities, by transmitting via high-tension wires additional power for use at its upper plant, in Fiskdale.

C. A. Tornquist is president; H. W. Hayward, treasurer, and W. H. Prichard, secretary, of the corporation, which employs upwards of two hundred operatives.

OTHER WINCHENDON CONCERNS

In 1912, Tom Wye, Inc., was incorporated, and today has capital of \$280,000. It manufactures men's, women's and children's sweater coats and bathing suits, and employs 200 operatives.

William M. Whitney is president; S. A. Greenwood, vice president; R. B. Greenwood, secretary, and Wm. H. Wye, treasurer. The plant is equipped with 138 knitting, twenty-four looping, and 110 sewing machines, and four boilers.

In 1923, William H. Brown, his son, William R. and others, erected a large factory and engaged in the production of packing tubs, cabinets, and other woodenware. Today the concern known as the Brown Package Company has capital of \$100,000 and employs fifty hands. One of the company's famous products is Temp-Tite, a container designed for shipping perishable commodities without ice. William H. Brown is president; A. C. Towne, secretary, and W. Raymond Brown, treasurer.

In 1925, the Winchendon Chair Company took over the chair manufactory business established in 1908, at Centerville, by Wendell P. Clark & Co. It employs 130 operatives and in addition to chairs manufactures novelty tables. J. H. Murray is president and P. H. Murray, treasurer. One of the numerous plants of the New England Division of the General Box Company is located at Winchendon, where wooden boxes and crates, of the nailed and wire-bound types are manufactured.

In 1929 the Superior Brick Company, of Boston, acquired land and erected a brick-burning plant, in the town.

If by chance the woman reader resorts to an exclusive shop on Fifth Avenue, New York, for the purpose of equipping herself with the latest in sport clothes, no doubt she will be shown the products of the Toy Town Tailleurs, made in Winchendon, in a factory located near where stood the town's first grist mill.

The Bullardvale Mills, of which A. S. Graton is agent, manufactures mattress shoddy and batting, the plant being equipped with four garnets, six pickers, two boilers and two water-wheels.

The New England Lock & Hinge Company, owned by H. C. Lord and A. M. Royce, employs twelve operatives in the manufacture of steel toys and light hardware.

The Toy Town Freezer Company, has capital of \$100,000 and is engaged in the manufacture of ice cream freezers. Mardis A. Brown is president; Charles T. Brown, vice president, and J. B. Roebuck, is treasurer and secretary.

CHAPTER LVII

IN RETROSPECT

Massachusetts need not emphasize her healthful climate, her superior educational facilities, the stimulating cultural and historical environment alone in this Tercentenary year of 1930, for it is apparent that there has grown up in this section within the past few years a new attitude of mind concerning the highly developed public service facilities and the diversity of manufacturing output of her long-established industries, which many years since passed out of the experimental stage, and which produce a traditional quality of commodities unmatched by those of any other section of the United States.

The new industries whose advent and progress are recorded at length in these volumes are not the result of accident, nor are they merely ephemeral in nature. The accessions have come because astute executives of industrial organizations saw in the financial situation here something that they did not observe elsewhere.

With but one bank failure in the entire six New England states in the past four years, they perceived that this is the only section of the United States that had not had from three to 196 in number *per year* during the same period of time.

They also noted that in 1927 the commercial failures in New England totaled but 2,465, with aggregate liabilities of \$55,000,000, whereas in New York state, with a manufacturing population not in excess of that of the six north-eastern states there were 3,248 insolvencies in the same period, with liabilities of \$90,000,000, and 1927 failures, with total liabilities of \$67,000,000, in the South Atlantic states that year—a section which by no means contains the manufacturing population of New England.

The trend of industry is back to the Bay State, with its vast reservoirs of skilled operatives, coupled with far-sighted management engaged in building for the future.

Nowhere else in this country, thanks to climatic advantages and to the long years Massachusetts has proceeded to manufacture on the factory basis, can there be found so compact a body of skilled operatives disciplined in the methods of modern industry. By reason of this, even in the cotton industry, Massachusetts is relatively immune from outside competition in the higher grades of products, particularly in those industries where the value of the commodities is largely enhanced by the labor added in manufacture.

Emphasis on two or three special lines of industry should not obscure the extent to which diversification of production has buttressed Massachusetts industry. Not all the eggs are here in one, or even in two of three baskets, and consequently the Bay State is not subject to the occasional ordeals that obsess one-crop or one-industry regions. Textiles and shoes represent only a fifth of the factory output of the Commonwealth.

Probably no section was called upon to face such a sudden and severe

testing from the whirligig of fashion in two of its major industries, as was manifested here in fabrics and footwear, and Massachusetts manufacturers displayed vision in coping with the bewildering problem of readjustment in the new shifting of styles and the keen competition in commodities.

The gospel of inquiry, research, adaptation, alertness, and the introduction of new ideas and new blood, all conspired to spur her manufacturers on, and aided by the financial institutions and revived railroads, Massachusetts industry, in its many roles, awakened to new effort and achievement.

And it was not accomplished by using such slogans as "Buy a Bale of Cotton," or "Wear Cotton Stockings To Help The Mill Towns." No Massachusetts textile men begged for a "hand out," or panhandled on the street corners in distributing their products. On the contrary, they have learned within recent years to consult the almanac, which shows the tides, and they no longer watch the waves as in days of yore.

Self-sufficient for three centuries, Massachusetts has become self-conscious during this second quarter of the twentieth century.

Reports of her industrial death have been frequently and invariably exaggerated, as in the case of the erroneous report concerning the premature demise of Mark Twain. Shortly after the forefathers landed on these shores they cut off the forests, and the local lumber business was said to be non-existent. But statistics tell us it is still worth \$25,000,000.

When the forest was cleared, the pioneers planted the soil, only to find it rocky, and our agriculture was reported dead. However, a recent governmental valuation showed improved lands in New England valued in excess of one billion dollars.

Then the denizens of Massachusetts turned to fishing and by primitive methods dried immense quantities of cod. This industry was reported dead, but it is still living, with an annual value of approximately \$19,000,000.

Next came the era of our trade conquest of the Indies and the world, the development of the Northwest fur business, and the gold rush of '49, which led to the building of a great fleet of clipper ships. Then it was asserted that our shipping business had expired, but today we have more tonnage than ever before in our history.

Next came the manufactures, and these were thought to be dead, although we still produce the best tools, shoes, paper, cotton fabrics, and electrical goods in the world, and while we may be dead, the estimated total wealth of this section is in excess of \$25,000,000,000.

HER INDUSTRIAL RESOURCES

The five primary factors attending the early development of Massachusetts industry were—available water-power that met the requirements of that period; the inventive genius and skill of its mechanics; the commercial resourcefulness of its population; the development of shipping and the accumulation of capital by a naturally thrifty people, who were forced to economize in order to live.

Not one of these factors had disappeared, except as the native water-powers have been supplanted by the more general employment of steam power, produced from coal, or as they are being superseded by hydro-electric energy and the use of fuel oil.

The inventive genius and skill of our mechanics and craftsmen are still our peculiar assets.

The business resourcefulness of Massachusetts has not been hampered by the industrial development of the West and South.

In connection with the fourth factor, the development of shipping, we find a renaissance in Massachusetts, due in a large measure to the opening of the Panama Canal, the very general use of which by our shippers is working to our economic advantage.

The accumulation of capital still operates in thrifty Massachusetts.

Add to these material and primary considerations the large body of skilled workmen; the possibilities on the St. Lawrence and in Canada of almost unlimited potential hydro-electric power which can be transmitted economically over long distance lines; the material expansion of our foreign trade; the ability of successive generations to overcome obstacles which in their day seemed as insurmountable as those that now obsess us; the inventive genius and the able management of our corporations and the almost unlimited wells of capital; the established reputation for quality products possessed by our manufacturers; a climate conducive to high efficiency; wealthy banking institutions, operating under liberal policies; the possession of many of the greatest markets of the world, and our contiguity to others of major importance; factories that are built and paid for, thus relieving industry from the liability of being harnessed to a burden of debt; a veritable net work of rail lines leading to the finest harbors on the Atlantic coast; the highest proportion of hard-surfaced roads of any section in the country, thus serving overland trucking to better advantage than this means of transportation can employ elsewhere; with an exclusive advantage in the impetus of an early industrial start, and with the firmly established sterling reputation of our manufacturers for fair and honest dealings with their customers, it is clearly seen that we have in these factors peculiar advantages which no other section of the United States possesses and which they cannot easily overcome.

THE DIVERSITY OF OUR MANUFACTURES

From the very beginning Massachusetts manufacturers have made the names of their goods household words. Their advertising phrases stick and become a part of our daily conversational patter.

The major processes of living are carried out through their nationally advertised products.

We rise from our couch in the morning, and open the faucet, through which the water for our bath flows from plumbing fixtures that justify the alluring promises of the pictures. Our Hampshire County tooth brush is world renowned and the cleanser we apply does exactly what the billboard said it would. We bathe our necks with a cotton face cloth made in a Middlesex County textile mill and we apply a soap produced in Cambridge, which serves Kings in their palaces, as well as little unfortunates, in the orphan asylums. We seize a Boston-made razor and apply a Bay State shaving cream to our face. Doffing our Bristol County-made pajamas, we don a union suit fabricated in Norfolk County; pull on some Essex County-made socks; we lace up a pair of spiffy shoes manufactured in Plymouth County; we put on a broadcloth shirt woven in one of our Bristol County mills and fabricated in a Worcester County shirt

factory; we adjust a Boston-made necktie to a Massachusetts-made collar and fasten it to Attleboro gold collar buttons fore and aft; we pull on a pair of trousers belonging to a suit fashioned from the unrivaled woolen and worsted goods made in the mills of Essex County; we sit down to breakfast and indulge in appetizing tropical fruit purveyed by the world's greatest distributing agency—a Massachusetts corporation; we sip an appetizing cup of coffee, distributed from Boston where is centered the coffee market of the United States, and sweeten it with sugar refined in a Massachusetts factory; we partake of strictly fresh eggs from a Barnstable County hennerly, and some succulent bacon, prepared by an internationally known distributor whose progenitors went to Chicago from the Bay State many years ago, where they became the pioneers in shipping dressed meat to the Atlantic seaboard; we mash a mealy Middlesex County potato, swimming in rich Hampshire County butter and top off with breakfast cakes, floating in native maple syrup. We have a personal affection for the Massachusetts-made range, upon or in which some of these delicious viands have been prepared, and we are prepared to recommend it as a reliable “cooker.” We adjust our Amesbury-made hat, bound into our “leaping Lena,” and are propelled upon velvety Massachusetts-made tires to the corner grocery, where we leave an order for the “missus” for Bay State-made baking powder, spices, canned and package goods—we know just what we want and will take no other. We dive into the drug store, buy a good Massachusetts cigar, made of Connecticut valley tobacco, light it with a Springfield-made match, and purchase a box of Massachusetts confections—it isn't just candy, but it has a trade name known all over the world—for the stenographer's birthday.

With gusto we approach the mail; written on stationery produced in Hampden County mills, and signed with Massachusetts-made ink. We dictate to an up-to-the-minute stenographer who wields Massachusetts-made pencils on Bay State note books, and talk over the phone—a Massachusetts invention.

And so on the live-long day—the best for the money on the market—and we pay for these services and these commodities with money, all the paper for which is made in Berkshire County by Massachusetts artisans.

Truly the publicity managers didn't exaggerate an iota. Who makes all these articles that we use twenty-four hours a day? We promptly answer with the names of the reliable Massachusetts manufacturers who take pride in turning out quality products.

Let us turn to the other side of the picture.

IS THERE REALLY ANYTHING THE MATTER?

Twenty-five years ago, in order to be really up to date in Massachusetts, it was considered necessary to submit to an operation for appendicitis, and the sum total of vermiform appendices that went out via the operating table was infinitely greater than the list of subtitles contained in any loose-leaf cyclopedia of the twentieth century.

The appendicitis era having largely passed, what Massachusetts now needs more than anything else is a group of surgeons who will precipitate a carnival of operations for the removal of the spleens of chronic critics of existing industrial and commercial conditions.

We need to conjure up a Dr. Mussolini, who, instead of placing a head tax on bachelors as is now provided in sunny Italy, would make it incum-

bent upon all grouches to submit to periodical examinations and where diagnoses indicate such disorders as result in mental or physical inability to differentiate between industrial change and industrial decay the victims should become subjects of artistic carving at the hands of competent knife-wielders.

In the last analysis, there is nothing the matter with Massachusetts, as incontrovertible facts and figures clearly indicate, and once the strident voices of local joy-killers could be stilled our cup of joy would be complete.

When machine tool manufacturers in southern Ohio, and the manufacturers of automobile parts in the northern section of that state, were caught in the trough of industrial readjustment following the World War, were there queries of "What's wrong with Ohio?" or "Is Ohio slipping?" No!

When a definite trend toward the South was observed in the furniture industry was the question bandied about, "Whither Michigan?" It was not.

When the bituminous coal industry found itself in shoal water, the world did not inquire "Can West Virginia come back?"

And yet, every economic and industrial readjustment within the confines of Massachusetts, or of New England for that matter, traditionally become the starting-point for idle patter about the decline of the Bay State, or of the six north-eastern Commonwealths, until it seems that the great New England delusion is that all industrial changes, relocations and readjustments occurring within this geographical area are due to some "fault" in the local strata.

The delusion that industrial problems of the tough, complex and apparently insoluble type are an exclusively Massachusetts product, and the belief entertained in some quarters that all other sections of the United States are immunized against the difficulties that Bay Staters are called upon to meet and solve, have no justification in fact. The changes that have swept through industry during the past decade have known no geographical boundaries, and the new economic alignments which have pitted industry against industry in keen competition for the consumer's dollar, have not been confined to states, sections, or even nations.

An over supply of industrial brick, cement and machinery is not the exclusive property of Massachusetts, nor of any other section of the country, any more than are increased selling costs or price competition. These factors are not Massachusetts inventions.

Her industrialists have their share of problems, but so do the manufacturers of New York state, Pennsylvania, Ohio, Illinois, and all other industrial states.

Massachusetts has her share of well-conducted and prosperous mills and factories which will continue to lead in the future as they have in the years that have gone. There has been enough of destructive analysis and side-line criticism, and the hour has arrived for constructive action.

The industrial assets of Massachusetts are imposing in diversity bulk, and character. Her plants, labor, financial stability and resources, harbors, transportation and power facilities, proximity to markets, traditions of workmanship, and quality products are typical of the renaissance which is being brought to pass by the aggressive efforts of industrial executives, workers, bankers, and business men.

Surely a state whose contribution to the internal revenue receipts of

the nation in 1928 increased \$2,284,522 over that of 1927, or from \$109,002,869 in the latter year, to \$111,287,380 in 1928, and whose income taxes from corporations and individuals rose from \$99,966,598 in 1927 to \$105,167,720 in 1928—a gain of \$5,201,122, which is exceeded by Illinois, New York and Pennsylvania only—can scarcely be said to be decadent. Such was the Massachusetts record in 1928.

Likewise it cannot be said that the Bay State is not attended by prosperity when the 1928 figures showing the savings deposits in the banks and trust companies of the Commonwealth indicated that in that year there were 4,139,765 depositors in these institutions, whose savings aggregated \$2,652,725,000, or an average of \$618 per inhabitant—a gain in savings per inhabitant in 1928 over 1927 of 43 per cent—a figure unapproached in any other state in the Union. Poverty-stricken and idle men and women cannot tuck away financial nest eggs in savings banks. They do not do it in any section of the country.

THE GLORIES OF THE FUTURE

Glorious as is Massachusetts' record of accomplishments, the best is yet to come. The greatest asset of her people is their progressive spirit—an attitude that decades ago overflowed the geographical boundaries of the Bay State to found and build up the great middle and far western sections of the United States, and which is continually regenerating in its original habitat as well as where it has been transplanted.

For almost a century Massachusetts has lavished its men and women on the West and South. The Forty-niners trekked across the plains in their covered wagons, eager for the new Eldorado on the slopes of the Pacific. Many died on the way, but many more found homes in the Middle West. Capital in large sums went with the pioneers to develop the railroads, mines and early industries of the Central and Far West.

It is this spirit, coupled with the proverbial "New England conscience" that insures the future of this section of the United States. It has overcome obstacles in the past; it has produced new methods; it has improved old conditions; it has steadily advanced the goal; it has proved its alertness in countless fields of human endeavor; it has always been mindful of the sacred obligations that go hand in hand with progress and prosperity; it has appreciated that its dominant place in the life of the nation came not by accident, but by the strenuous, unrelenting efforts of a courageous people who appreciated that the natural advantages of their environment were infinitely greater than the obvious disadvantages, and who were so clear visioned in their estimate of values and so unerring in their judgments that they made few mistakes.

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Baker made carriage trimmings	1209	Beacon Narrow Fabric Co.	180
Baker Mfg. Co., The	217	Beacon Oil Co.	929
Baker-Stewart-Jenkins Shoe Co.	413	Beacon Press, The	1390
Baker-Vawter Co.	627	Beaumont, James	39, 41
Bakeries consolidated	1451	Beaumont Manufactures satinets	68
Balanstat Corporation, The	565	Beaumont mill in Canton	64
Balch produced "roan" or Morocco shoes	345	Beaver Mfg. Co.	410
Baldwin Chain & Mfg. Co.	1782	Beaver Mills, The	127
Balfour Co., G. L.	256	Beck, Inc., Wm. and Charles	343
Ball, Phineas	1738	Beckwith Bro's. Co.	656
Ballard Vale Mills Co.	409	Beckwith Elevator Co.	1481
Ballou Mfg. Co.	255	Bedford industries	979
Balmoral skirts, satinets blankets	88	Bedson mill installed at Grove Street mill	1671
Banister Co., The A. W.	842	Bedsteads made	720
Bank note paper	140	Bed ticks, gingham, shirtings	66
Bannockburn Mills, Inc.	288	Bee, Benj. F., hand machine shop	97
Barber Electric Mfg. Co.	286	Beebe & Holbrook	604
Barbed wire patents, men, lawsuits	1672	Beer and whiskey grains prices fixed	24
Barber Leather Co.	127	Beer formula by legislature	24
Barber Mfg. Co., The	748	Beggs & Cobb, Inc.	961, 1057
Barbour Stockwell Co.	789	Beginning of industry in Boston	1247
Barbour Welting Co.	1488	Beginning of our patent system	302
Barlow Co., The	601	Beginning of Reed & Barton unit	227
Barnaby Mfg. Co.	177	Beginning of Saco-Lowell shops	733
Barnard and Sagamore Mfg. Corp-orations	175	Beginning of silversmithing	389
Barnard & Co., Inc., F. J.	1277	Beginning of Taunton's tack industry	232
Barnard & Sons, J. W.	411	Beginnings of comb industry	1842
Barnard Foundry Co.	568	Beginnings of Florence Stove Co.	695
Barnes Co., Henry K.	1451	Beginnings of Hopedale	1912
Barnet & Sons, J. S.	323	Beginnings of industrial revolution	47
Barnett Co., Inc., M. H.	568	Beginnings of paper industry in Berk-shire County	19
Barney & Berry Skate Co.	502	Beginnings of Smith Paper Co.	149
Barnstable County industries	94	Beginnings of South Works	1667
Barnstable County's largest industry	100	Beginnings of Spencer Wire Co.	1955
Barr, Robert	31	Beginnings of U. S. Envelope Co.	502
Barr Chemical Co.	383	Belcher & Taylor Agricultural Tool Co.	630
Barre, home of Yankee horse rake	1879	Belcher Malleable Iron	271
Barrows & Co., H. F.	280	Belchertown	709
Barrows & Co., Inc.	1584	Belding-Hemingway Co.	696
Barta Press, The	822	Beldings, Milo M., Hiram H. and Al-vah N.	695
Bartlett, Samuel	11	Belmont's industries	979
Bartlett, Gen. William F.	135	Bell, Alexander Graham, 1308, 1402, et seq.; given a year to live, 1405; meets Sanders and Hubbard, 1405; and Watson meet, 1407; experi-ments with human ear, 1407; con-fides success to Sanders, 1408; trans-fers his experiments to Kilby Street, 1409; birth of the telephone, 1411; prepares the original speci-fications, 1413; "Watson, come here," 1415; Dom Pedro saves day for, 1416; Sir William Thomson's hears test, 1417; returned to Boston, 1419; and his angry landlady, 1421; patented idea of using two conductors 1423; becomes dis-couraged, 1423; sailed for Quebec, 1423; demonstrated 'phone abroad, 1423; experiments with silenium—produces radiophone, 1424; receives the Volta prize, 1425; detractors not silenced by his death, 1426; Vail, T. N., 1427; Telephone Co., National, 1429; and Watson talk—San Fran-cisco to New York, President Wil-son, Vail listened in	1431
Barton, Rice & Fales Co.	582		
Baseball Magazine	758		
Baseballs and footwear	1014		
Batchelder, Samuel	53, 1294		
Bates Machine Co., E. V.	754		
Bates & Bacon	248		
Bates & Klinke	257		
Bath & Co., Inc., John	1801		
Battelle, Ebenezer	776		
Battery Containers, Inc.	770		
Bauer, Henry	343		
Baush Machine Tool Co.	518		
Bayberry candles	96		
Baylies' Iron Works	226		
"Bay Psalter Book"	775		
Bay State Belting Co.	1465		
Bay State Brick Co.	809		
Bay State Corset Co.	521		
Bay State Crucible Co.	241		
Bay State Elevator Co.	118, 521		
Bay State Envelope Co.	1724		
Bay State Fishing Co.	1619		
Bay State Gold Pen Co.	278		
Bay State Leather Co.	563		
Bay State Metal Works	841		
Bay State Mills of Lawrence	328		
Bay State Mop Co.	961		

Bell & Co., W. H. -----	283	Blackstone's manufactures -----	1881
Bell Co., The -----	1803	Blake, George Fordyce, 805; "Incorporated" -----	1770.
Bell Leather Corporation -----	383	Blake, inventor of sole-cutting machine -----	811
Bell Telephone first demonstrated -----	590	Blake & Knowles -----	620
Bellingham products -----	1080	Blake & Knowles Works -----	805
Bemis, David -----	62	Blake Mfg. Co. -----	522, 556
Bemis, Seth -----	39, 61	Blake's invention -----	1149
Bemis Associates, Inc. -----	1043	Blanchard, Samuel -----	53
Bemis & Call Co., Coming of -----	491	Blanchard, Thomas, 1194; inventor of world's famous lathe, 1928; other inventions of, 1929; 1960; story of gun stock, 1961; "turned the heads of Congress" -----	1962
Bemis Car Box Co. -----	516	Blanchard & Kimball -----	498
Bemis Car Truck Co. -----	516	Blanchard Instrument Co. -----	789
Bemis lights plant by gas -----	63	Blanchard made scythes -----	671
Bendix-Cowdrey Brake Tester Co. -----	1834	Blanchard Machine Co., The -----	847
Benefits of power exchange agreement -----	1444	Blanket production begun -----	204
Benson, H. F. -----	622	Blair Mfg. Co. -----	517
Bentley Hair Co., Jos. -----	416	Bliss & Perry Co., The -----	395
Berkley industries -----	263	Bliss Holbrook Co. -----	256
Berkshire County towns in industry -----	129	Blood, Josiah B. -----	323
Berkshire Fine Spinning Associates -----	90	"Bloomerie" in Taunton -----	226
Berkshire Mill No. 1 -----	88	Blue Diamond Materials Co. -----	1593
Berkshire Sheet Metal Works -----	117	Blush erected brick woolen mill -----	721
Berkshire Woolen Co. -----	118	Boats, dies, toys -----	415
Berry-Walker Co., The -----	1582	"Body of Libertys" published -----	14
Barryman, Lieutenant -----	1307	Bofel Rug Co., The -----	764
Best Printing Co.-Caustic-Clafin Co. -----	1385	Bogert & Hopper, Inc. -----	476
Best Printing Co., W. S. -----	1385	Bog iron discovered -----	297
Bettinger Enamel Corp. -----	954	Boies, Jeremiah Smith -----	19, 1260
Beverly -----	375	Boies starts factory -----	65
Beverly Cotton Manufactory got character -----	52	Bolt-heading machine -----	502
Beverly Cotton Mill -----	51	Bolton & Sons, Inc. -----	339
Beverly's second cotton mill -----	60	Bonnett, John P. -----	283
Bickford & Washburn -----	452	Book bindery started -----	1351
Bicknell & Snyder enterprises -----	1761	Book paper values -----	579
Bicknell-Thomas Co. -----	455	Boothby Fibre Can Co. -----	1585
Bicycle Clubs and Races -----	646	Bootlegger of industry -----	388
Bicycles and whips -----	640	Boott, Kirk -----	730
Biddle & Smart Co. -----	399	Boott Mills, The -----	738
Bidwell, Paul W. -----	590	Booth Fisheries Co. -----	373
Big Chimney drew people for miles -----	279	Booth Mfg. Co. -----	208
Bigelow, Cheney -----	495	Borden, Holder -----	165
Bigelow, Erastus B., 1884; invention revolutionized cotton industry, 1890; Brussels carpet loom his greatest invention, 1890; produces power loom to weave wire cloth -----	1892	Borden & Remington Co. -----	186
Bigelow, Horace H. -----	1728	Borden & Sons, Inc. -----	167
Bigelow, Kennard & Co. -----	1291	Bordens, The -----	160-168
Bigelow-Sanford Carpet Co., Inc. -----	1896	Border City Mfg. Co. -----	174
Bigelow's heeling machine -----	1156	Bosch Magneto Corporation -----	542
Bigelow's machines for printing wall-papers -----	1322	Boston Almanac for 1837, quoted -----	1280
Bigney Co., The S. O. -----	252	Boston and Brantford (phone) experiments -----	1418
Billerica -----	979	Boston & Lockport Block Co. -----	1312
Billiard tables and bedsteads -----	58	Boston & Springfield Mfg. Co. -----	629
Billings, Samuel D. -----	435	Boston as a shoe mfg. center -----	1587
Binder twine in trainloads -----	1220	"Boston" baked beans from Melrose -----	957
Bingham, Pliny -----	75	Boston Bank Note Co. -----	1476
Binner Corporation, C. S. -----	1476	Boston boatbuilders -----	1375
Bird, Henry M. -----	809	Boston Brass Co. -----	954
Bird & Son, Inc., Romance of -----	1126	Boston Bridge Works, Inc. -----	818, 1432
Bird Co., J. A. & W. -----	1026	Boston builds hundreds of railway locomotives -----	1287
Bird Machine Co. -----	1128	Boston Consolidated Gas Co. -----	1279, 1283
Birnie Paper Co. -----	524	Boston Daily Advertiser, 1822, quoted -----	1279
Birnie Sand & Gravel Co. -----	668	Boston Directory -----	1325
Birth of Naumkeag Steam Cotton Co. -----	358	Boston Edison Co. -----	1438
Birth of textile industry on Massachusetts soil -----	38	Boston Edison tie, The -----	1442
Birth of the telephone -----	1411	Boston Electric Heating Corp. -----	1234
Birth of United Shoe Machinery Corp. -----	1165	Boston enterprises formed in the '30s -----	1294
Bishop, Beals & Co. -----	641	Boston enterprises of decade 1840-50 -----	1334
Bishop Co., Inc. -----	286	Boston enterprises of the '50s -----	1366
Bishop Co., J. W. -----	1757	Boston experiment in linen making -----	29
Bissell's New York purchase -----	103	Boston Fibre Co., Everett -----	928
Blackburn, John -----	69	Boston Gear Works Sales Co. -----	1076
Blackinton, Col. Willard -----	245	Boston, "hub of universe" -----	1236
Blackinton, V. H. -----	280	Boston Ice Co. -----	1380
Blackinton & Co., R. -----	282	Boston Insulated Wire & Cable Co. -----	1552
Blackinton Mills -----	158	Boston inventions of 1826-28 -----	1290
Blackinton's first factory -----	121	Boston Machine Works Co. -----	322, 1494
Blackstone Mfg. Co., Mendon -----	76		

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Brown's Beach Jacket Co.	1789
Brownell & Burt, Inc.	242
Brownell, George L.	1773
Brunscene Co., The	1043
Brush, Charles F.	313
Brushes	656
Bryant, Gridley	1067
Bryant, Seth	1151
Bryant Box Co.	655
Bryant Knitting Mills	914
Buchanan & Bolt Wire Co.	593
Buck began carriage making	1018
Buck Chair Co., Inc., E. R.	1903
Buck made fishermen's boots	97
Buck Printing Co.	1347
Buckland industries	431
Buckles not mates	291
Buckleys built wall paper mill	721
Bugbee & Niles Co.	280
Buggies give way to auto bodies	398
Buld Berkshire's first paper mill	138
Building better baskets	710
Building on enduring principles	1042
Bullard Thread Co.	611
Bullards made shoes	1004
Bullock, Asa	82
Bullock Mfg. Associates	516
Bunker Hill Breweries	1278
Bunker Hill Quarry	1067
Burgess, Frank	1077
Burgess, Thomas	10
Burk, Edmund	435
Burke & Son, F. L.	414
Burley & Usher	395
Burlingame Machine Co., The	1740
Burnham, James	39
Burnham & Davis Lumber Co.	747
Burnham Boiler Corporation	877
Burns Co., William H.	1767
Burt, Edward	25
Burton Co., A. & E.	786
Burton-Rogers Co., The	1590
Bus Structure Co.	556
Butler Mill	203
Butterfield Printing Co.	754
Butterworth Carpet Co.	633
Buttonhole machines	1163
Button maker forerunner of jewelry mfg.	245
Butts & Ordway Co.	1478
Buxton, Inc.	558
Buzzell's edge trimming machine	1161
Byfield Woolen & Felt Co.	418

Cabot, Samuel	777
Cabot, Inc., Godfrey L.	1453
Cabot, Inc., Samuel	1628
Cabots, John, Geo. and Andrew	51
Cain Co., John E.	875
Calico printing introduced	731
Caliope invented in Worcester	1728
Calkins made chairs	661
Calumet & Hecla	1355
Calvin Putnam Lumber Co.	412
Cambec Tool & Stamping Co.	564
Cambridge Chocolate factory	830
Cambridge Electric Light Co.	801
Cambridge enterprises of the '90s, Some	838
Cambridge Gas Light Co.	799
Cambridge of forty years ago, The	837
Cambridge industries, Some prominent	871
Cambridge industries, Various	877-882
Cambridge Paper Box Co.	849
Cambridge Rubber Co., The	868
Cambridge starts building passenger cars in '30s	781
Cambridge Waste Co.	875
Cambridge's extensive facilities	774

Cambridge's industrial development --	773	Chace Mills -----	173
Campbell printing press -----	233	Chadwick Copying Book Co. -----	572
Candle and soap making -----	804	Chaffee, E. M. -----	816
Candies, bricks, carriages -----	817	Chaffee and Haskins made rubber products -----	1274
Cando Corporation, The -----	872	Chaffee Bros. Co. -----	1941
Canoe River Mills -----	236	Chains -----	250
C. M. Metal Products Co. -----	564	Chair town of the Universe -----	1852
C. & P. Electric Works, Inc. -----	568	Chairs made prior to 1766 -----	389
Cans, bricks, carriages -----	817	Chamberlin, Burr -----	135
"Can't be done?" -----	786	Chandler, Samuel -----	54
Canton industries -----	1084	Chandler Co., The -----	524
Cape Ann Anchor & Forge Co. -----	372	Chandler Oil Cloth & Buckram Co. -----	242
Cape Ann Tool Co. -----	427	Changing industrial era -----	907
Cape & Vineyard Electric Co. -----	802	Changing Industrial Picture, The --	771
Capacity of cotton units, 1837 -----	742	Changing methods of production -----	35
Cape Cod chemist capitalizes herring scales -----	94	Changing styles in woollens and worsted -----	109
Cape Cod Preserving Co. -----	98	Changing tide in Westfield industries	651
Cape Cod Shipbuilding Corp. -----	1231	Changing tide of industrial production	356
Cape Cod United Products Co. -----	94	Channeling machines -----	1160
Cape Cod Windmill Co. -----	97	Channing Smith Textile Corporation --	1924
Cape Cod's early mills -----	9	Chapel Machine Co., The -----	108
Capital of Beverly's mfg., concerns --	376	Chapin, O. R. -----	1153
Capital, spindles, employees -----	741	Chapin & Gould Paper Co. -----	531, 721
Capital \$3.15; debt, \$145.60 -----	696	Chapman quick acting electric limit switch -----	683
Capitalizing lumber resources -----	2	Chapman Valve Mfg. Co. -----	512
Capron, Charles C. -----	70	Chappell, R. S. -----	43, 81
Car and paint makers -----	358	Charlemont Manufactures -----	433
Carbon papers for Cambridge -----	876	Charles River Iron Works -----	837
Card, Simon W. -----	277	Charles River Paper Co. -----	954
Cardmakers, gloves, furriers -----	33	Charlton industries -----	1883
Career (of Crocker) as railroad builder	1824	Charlton Mills -----	180
Carew Mfg. Co., The -----	722	Chartley Iron Works -----	226
Carleton & Hovey Co. -----	746	Chase, Elder Moses -----	401
Carey Co., The W. W. -----	749	Chase, Job -----	26
Cargill, Cleveland & Co. -----	656	Chase & Co., Inc., C. P. -----	527
Caring for welfare of textile workers	733	Chase & Co., L. C. -----	1329
Carpenter and salt maker came -----	3	Chase & Sanborn Corporation, The --	1373
Carpenter Die & Tool Co. -----	288	Chase Turbine Co., The -----	470
Carpenter-Morton Co., The -----	917, 1332	Chatham industries -----	96
Carpenters, The -----	77	Cheever, Tweedy & Co. -----	283
Carpet plant Palmer's oldest factory	673	Chelmsford Ginger Ale, Inc. -----	983
Carpets -----	1348	Chelmsford's industries -----	981
Carr Fastener Co., The -----	863	Chelmsford's pioneer concerns -----	85
Carriage building at Cambridge -----	781	Chelsea -----	1628
Carriage cloths exclusively -----	106	Chelsea Clock Co., The -----	1637
Carriages, cans, bricks, candies -----	817	Chemical Paper Co. -----	612
Carroll & Co., J. E. -----	761	Cheney Bigelow Wire Works -----	495
Carrolls, inventions of, -----	1757	Cheshire made first plate glass -----	134
Carson, Thomas -----	135	Chesley & Rugg -----	347
Carter Co., William -----	568	Chesterfield -----	709
Carter Co., The William, Founding of --	1110	Chester Granite Quarries, Inc. -----	661
Carter, Qvarnstrom & Remington -----	254	Chesterton Co., A. W. -----	957
Carter's Ink Co., The -----	791	Chickering, Jonas -----	1283, 1667
Carver, Eleazer and the Cotton Gin --	1200	Chickering & Sons -----	580
Carver makes America's first cast- iron Kettle -----	1200	Chickering & Sons, Inc. -----	1283
Caseys erected shoe factory -----	100	Chicopee -----	629
"Cash and Carry" system fostered --	323	Chicopee Falls bridge -----	637
Casper Ranger Lumber Co. -----	628	Chicopee Falls Wheel Co. -----	633
Cass Co., N. D. -----	1873	Chicopee Mfg. Corp. more than 100 years old -----	629
Cat came back, The -----	1016	Chicopee's third largest industry --	630
Catering to Milady's whims -----	346	Children in industries -----	27
Catering to needs of dame fashion --	1670	Chilson Auto Top Shop -----	706
Catering to the sweet tooth of the world -----	854	Chilson, Gardner -----	277
Caustic-Clafin Co. -----	1385	Chilton, Mary -----	392
Cave Welding Co. -----	537	Chipmans and Bigelow began shoe making in 1842 -----	965
Celebrated for tooth brushes, silks etc. -----	687	Chronological record, early textile enterprises -----	38
Celebrated shoemaker, The -----	302	Chubbuck an inventor -----	1193
Cellugraph Engineering Corp. -----	428	Church Mfg. Co., C. F. -----	602
Census figures, 1810, 1850 -----	717	Churchill Co., Inc., L. P. -----	263
Centennial Mill -----	136	Churchill Mfg. Co., The -----	764
Center of Writing Paper Mfrs. Assn. --	501	Cigar making -----	650
Centralization policy influence -----	2	Cinder Concrete Units Corp. -----	890
Central Ry. Sign Co. -----	905	City Brass Foundry, The -----	186
Central Shoe Co. -----	1583	City Dye Works -----	571
Century-old Pontoosuc Woolen Co. -----	106	City Mfg. Corporation -----	200
Certified Foods, Inc. -----	651		
Chace, Oliver -----	40, 170, 295		

City of Amazing industrial develop- ment	883	Comb industry started	1842
City of diversified industries.....	387, 942	Comb Shops in Newburyport and West Newbury	393
Civil War made mills	334	Comey's inventions	1154
Clairmont Woolen Co.	674	Coming of Ford Motor Co. to Somer- ville	887
Clap & Co., Harvey	252	Coming of Giles Tinker	120
Clapp, Benjamin	43, 83	Coming of leather manufacturers	301
Clapp & Son, Inc., Otis	1310	Coming of "The Bay Stater"	1323
Clapp & Son, Inc., Story of	1135	Coming of Thomas A. Edison	313
Clapp-Eastham Co.	865	Coming of Zenas Crane	137
Clapp Rubber Co., E. H.	1203, 1379	Commercial Bulletin, First No. of	1562
Clark & Sons Co., Alvan	796	Commercial Welding Service	563
Clark, Benj.	69	Commonwealth Press, The	1767
Clark, Henry Harrison	130	Commonwealth Shoe and Leather Co.	1233
Clark Lighter Co.	288	Commonwealth Supply Co.	404
Clark Mfg. Co.	627	Company overcomes many difficulties	1216
Clark Paint & Varnish Co.	561	Company refuses to sell to outsiders	1206
Clarke, Richard	18	Company seeks larger quarters	114
Clarksburg	134	Competitors bought up	274
Clay for bricke and tyles	21	Conant, Frederick W.	435
Clayton Mfg. Co.	952	Conant, Joseph	694
Cleary Mfg. Co.	627	Conant Ball Co., The	1855
Clegg Mfg. & Tool Co.	255	Conant Bro's. Co.	884
Clemence and Parker Wire Goods Companies	1951	Conant, Houghton Co., The	764
Clement Mfg. Co.	706	Conant Machine Co.	987
Cleveland, Alfred E.	858	Concern locates in Watertown	1050
Cleveland, E. C., inventor and manu- facturer	1732	Concern moves to Westfield	647
Clifton Mfg. Co.	1473	Concern offers distinctive paper for bank notes	140
Climax Paper Box Co.	865	Concern ventilates White House	1315
Clinton's industries	1900	Concerns established in 1893-94	841
Clquot Club Co., Romance of	1103	Concerns formed in the '70s, Some	817
Close Co., George	820	Concerns of more recent times	913
Clothing situation surveyed	27	Concerns that add to children's hap- piness	1861
Cloutier, Wm.	564	Concklin, Ananias	22
Coates Clipper & Mfg. Co.	1759	Concord Manufactures	986
Cobb & Drew, Inc.	1210	Condit Electrical Mfg. Corporation	1499
Cobb Co., J. L.	279	Confectioners	854
Cobb's Iron Works	226	Congress inspects cocoonery	693
Coburn, Lemuel	599	Congress shoe called for elastic web	712
Coburn Co., C. B.	742	Connecticut Mills, Amer. Woolen Co.	1514
Coburn Trolley Track Mfg. Co.	599	Conquering another engineering problem	646
Coco-Cola Bottling Co.	876	Consolidated Electric Lamp Co.	411
Cocheco Mfg. Co.	329	Consolidated Rendering Co.	568
Cochrane, Alexander	981	Consolidation of 1891 (Tack Co's.)	274
Cochrane Chemical Co.	921	Consolidation of 1926 (laundries)	1060
Cod liver oil plants	98	Consolidation of rolled plate con- cerns	259
Coes, Avery	492	Continental Baking Co.	615
Coes, Loring	492	Continental Wood Screw Co.	216
Coes Wrench Co.	1711	Contracted for prison labor	63
Coffin, Charles A.	308	Contribution of Bristol Co. Towns to Bay State Manufactures	263
Coffin introduced incandescent lamps	312	Contribution of Horace H. Bigelow to Shoe production	1728
Coffin Valve Co., The	1365	Contributors to Atlantic Monthly	1361
Cogswell Mfg. Co., The	683	Converse & Co., W. W.	673
Cohannet Mills	236	Converse & Son Co., Morton E.	1991
Cohannet Silver Co.	240	Converse, Edward	1054
Colburn, Beniah	422	Converse Rubber Co., The	911
Cole, Timothy	9	Convict labor employed	776
Coleman & Keating Co.	1350	Conway products	435
Coleman, Hezekiah	9	Cook & Sons, Charles	717
Collins-Lee Co., The	1636	Cook Co., C. A.	978
Collins Mfg. Co.	627	Coolidge, Hon. Calvin	687
Collins Paper Co.	686	Coolidge ordered out troops	689
Colonial Art Co.	656	Cooper Co., Leo. M.	183
Colonial Braiding & Weaving Co.	428	Cooper-Williams, Inc.	1574
Colonial Brass Co. of Middleboro.	1212	Copeland & Co., J. O.	288
Colonial Candle Co.	94, 96	Copper industry	1353
Colonial Press, Backers of	13	Copper wire comes into its own	1678
Colony & Osgood	872	Coppus Engineering Co.	1796
Colt built paper plant	108	Corbin & Son Co., B. A.	968
Colton Elastic Web Co.	765	Cordage	190
Colton Elastic Web Co., Geo. S.	713	Cornell, Ezra	1304
Columbia Jewelry Co.	847	Cornell Mills	178
Columbia Mill makes first wood pulp paper in U. S.	149	Corr Mfg. Co.	240
Columbia Specialty Co.	200	Corr's Cotton Waste Mill	242
Columbia Textile Co.	763		
Columbia Wheel Co.	648		
Colvin, Caleb, started foundry	1737		
Comb Companies	1848		

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Daye, Stephen	775	Douglas, William L.	1174
Dean, Stephen	8	Dover Stamping & Mfg. Co.	781
Dean & Sherk	673	Dover's famous portable houses	1092
Dean Cotton Mill, of Taunton	84	Dow Co., The F. H.	857
Deane-Blake-Knowles plant	623	Dow & Gillett	640
Deane Works, The	620	Dowae Toys, Inc.	684
Debt of the World to a New Englander	309	Downer, Arthur T.	1059
De Cady Corset Co., The	763	Downer successfully meets a crisis	1060
Decorative Metal Co., Inc.	242	"Downer's folly"	1060
Dedham's Water-power source	1089	Dowse, Edward	75
Deerfield products	435	Doyle, Joseph J.	252
Defiance Mfg. Co.	292	Dracut enterprises	988
Dejonge Co., Louis	1835	Drake Bakeries, Inc.	1614
De Long & Prevost	1801	Draper, Ira	191
Demarest & Bradley	252	Draper family's inventions	1910
Dena Shoe Co., The	350	Draper corporation's great contribu-	
Dennison, Aaron L.	944	tion, to textile art	1918
Dennison Mfg. Co., The	98, 990	Drapers purchase Dutcher patents	1915
Dennison Watch Case Co.	945	Draper's wonderful inventions, George	1914
Densten Felt & Hair Co.	383	Drew & Co., C.	1210
Derby & Co., Inc., P.	1854	Dryden, Artemas	82
Dery Corporation, D. G.	241	Duchemin's inventions	1154
Desire to enhance production	4	Duck produced was good	32
Desjardins Briar Pipe Co.	187	Duckworth Chain & Mfg. Co.	511
Despard, Lambert	35	Dudley, Deputy Gov. Thomas	8
Development of Electrical art at Pittsfield	115	Duffy Mfg. Co., Geo. E.	1798
Development of the River Works	318	Dunham, Hamlin G.	674
Deviled ham introduced	1049	Dunn & Co., M. J.	569
Devoe & Reynolds Co., Inc.	1323	Durant, Thomas	88
Devon Mills, Inc.	209	Durfe, Col. Joseph	44, 83, 161
Dewey, F. E. & B. A.	569	Dustbane Mfg. Co.	414
Dewey and Almy Chemical Co.	870	Dutton & Co., E. P.	1332
Dexter Lumber Co.	187	Dutton Co., Andrew	1468
Diamond Match Co.	554	Dwight Mfg. Co.	495, 630
Diary frozen in cake of ice	798	Dwights, J. and E.	629
Dibble & Randall	641	Dwight's Journal of Music	1293
Dibble Lumber Co.	127	Dwinnell Wright Co., The	1337
Dickinson, Levi	716	Dye Stuffs	568
Dickinson, Monroe	120		
Dickinson Hard Rubber Co.	518	E	
Dickinson Type Foundry	1297	Eagle Cotton Mill Co.	235
Dies, boats, toys	415	Eagle Shoe Mfg. Co.	927
Dietz Baking Co.	615	Earle & Co., Timothy K.	1714, 1737
Dighton Mfg. Co.'s Cotton factory	263	Earle Co., F. E.	217
Dighton Rock Pants Co.	239	Earliest Newton Industries	894
Dighton Stove Lining Co.	264	Early adventures in metal trades	34
Dighton's industries	263	Early attempt to produce gas from oil unsuccessful	1279
Dillon Machine Co.	339	Early attempts to establish manu- factures in Colonies	1
Diamond-Gryn-Kraut Kid Mfg. Co.	384	Early bookbinders of Boston	17
Dining cars	490	Early Brookfield enterprise	1882
Directories other than Boston's	1327	Early Cambridge booksellers	777
Directories—Publishers of	536	Early capacity 118 miles of shaving edge	1537
Discovery of a new art, speech tele- phony	1403	Early "get rich quick" scheme	692
Dispatching solid trainloads of binder twine	1220	Early glass manufactures	22
Distilleries	715	Early grist, wind and tide mills of Cape Cod	9
Ditson Co., Oliver	1292	Early industries of Lowell	729
Diversified industries of Fitchburg	1827	Early industries of Norton	292
Diversified production of Springfield	572	Early manufacture of cards	1256
Diversified production program	734	Early mills in Monroe	455
Diversified products of towns of Nor- folk County enjoy wide distribution	1080	Early mills—some other	10
Diversity of industries (Boston)	1245	Early paper mills and makers	1249
Diversity of our manufactures	1997	Early promoters of leather making	301
Diversity of products—Newburyport's	387	Early rubber enterprises of Boston	1274
Dividends of New Bedford cotton mills	225	Early sawmills	6
Dix Lumber Co., The	858	Early shoe makers of Marlboro	965
Doane & Williams Co.	627	Early silversmiths	389
Dodds Granite Co.	1927	Early thrift campaign	140
Dodge, Nathan D.	394	Early type foundries	20
Dodge, Silas	431	Early wall paper plants	20
Dodge, Thomas H., inventor	1720	Eames, Aaron	83
Dodge-Haley Co., The	873	Eames, Stimson & Co.	422
Dodge Shoe Co.	394	Earnshaw Knitting Co.	901
Donelson, Walter E.	435	East Boston Land Co.	1611
Doran, Bagnall Co., Inc.	289	East Longmeadow products	661
Dorchester Cotton and Iron Co.	65	East Weymouth Wool Scouring Co.	1138
Dorchester Pottery Works	1604	East Windsor	153
Doten-Dunton Desk Co.	856		

Eastern Bridge & Structural Co.	1788	Enterprises of 20th Century—impressive list of	182
Eastern Dairies, Inc.,	218, 628	Entwistle Co. T. C.	753
Eastern Expanded Metal Co.	841	Envelope Companies	1726
Eastern Felt Co., The	1058	Envelope machine patented	1723
Eastern Stage Co.	392	Eppler's Welt and turn sewing machines	1154
Eastham industries	96	Eppler inventions	1153
Easthampton manufactures	711	Ernest Scott & Co.	186
Easthampton Rubber Thread Co.	711	Erving Paper Mills	436
Eaton, Crane & Pike Co.	104	Essex County as Mfg. Center	430
Eaton Electric Furnace Co.	242	Essex County towns—Importance of, in industrial picture	398
"Echo Bridge"	900	Essex Gelatine Co.	383
Economic Machinery Co.	1789	Essex Shirt Co.	186
Economic significance of United Fruit Co's. operations	1509	Esleek Mfg. Co.	463
Economy Rug Works	754	Estabrook, J. M.	1153
Eden Co., C. H.	254	Estes Mills, The	169
Edes, Oliver, inventor of rivet machine	1221	Etna Co., The	240
Edgeworth Rubber Co.	908	Eureka Blank Book Co.	601
Edison, Thomas A.	306	Eustis Mfg. Co., The J. P.	847
Edison Electric Illuminating Co., of Boston	1434	Evans & Co., Inc., D.	279
Edison Electric Light & Power Co.	313	Evans Case Co., The	286
Edison General Electric Co.	313	Evans Stamping and Plating Co.	239
Edson Mfg. Corp.	1364	Even death did not silence de-tractors	1426
Edwards, John B.	1712	Everett	916
Edwards, Col. Wm., pioneer tanner ..	690	Everett concerns, various,	934-937
Effect of transition from hand to machine operation	311	Everett in 1885 and in 1927	916
Egremont's early marble quarries ..	143	Evereti Lamp Works	311
Eighteenth Century Boston industries ..	1253	Everett Works of General Electric Co.	927
Eighty-seven acre plant	606	Everett's other industries	934-937
Elastic fabrics, silks, tooth brushes ..	687	Everett's recent industrial development	934
Elastic Web industry	712	Ever Sharp File Co.	242
Eldredge Electrical Corp.	569	Evolution of American Bicycle	644
Eldridge & Co.	234	Ewing & Co., Hugh U.	59
Electric Arc Welding	637	Example of Massachusetts efficiency ..	1535
Electric Chain Co. of Mass.	254	Excelsior a Massachusetts product ..	1337
Electric Exercising Machine	571	Exhibit of jewelry made between 1780 and 1880	291
Electrical products of Pittsfield	102	Experiment at Rowley in 1643, The ..	49
Electrocuting doubting Thomases	1441	Explosion-proof building	116
Elektron Mfg. Co.	521	Export Trade and Finance	628
Elgin Silk Co.	183	Exports prohibited	33
Elimination of waste begun	370	Extent of equipment (Shepard's factory)	56
Elliott, John	775	Extent of Mfg. concerns, towns of Hampden County	658
Elliott, Rev. John	15	Extra tariff duties on nails	37
Elizabeth Poole Mills	236	Eyeletting and treeing machines	1162
Elliott & Douglas Mfg. Co.	255		
Ellsworth, Miss Annie	1303		
Elwell Iron Works, H. F.	569		
Ely Lumber Co.	610		
Emergency Fleet Corporation	1072		
Emerson, Bulkely	18		
Emerson, Daniel, Waltham blacksmith	944		
Emerson Apparatus Co.	957		
Emerson Mfg. Co.	340		
Emery, John, Jr.	10		
Emery, Michael	399		
Emmons Loom Harness Co., Advent of ..	337		
Emperor Dom Pedro saves day	1416		
Employee Industrial partnership plan	995		
Employees held own court	31		
Employees in Beneficial Association ..	678		
Encouraging linen and cordage production	28		
Enfield	715		
Engel Brothers	569		
Enlarging the line of products	1048		
English lords of trade investigate	19		
Endicott, Governor, quoted	4		
Englander Spring Bed Co.	1595		
Ensign Box Co., A. E.	651		
Enterprises established between 1820 and 1830	1278		
Enterprises established in the '70s	947		
Enterprises of Gloucester	373		
Enterprises of the '60s (Cambridge) ..	805		
Enterprises of this decade	553		
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		Fabric Weaving Co.	242
		Fabrics made at "Factory Village" ..	78
		Fabyan Woolen Co.	70
		Factories established at Douglas and Sandwich	76
		Fairclough & Gold, Inc.	1544
		Fairhaven Iron Foundry Co.	276
		Fairhaven Mills	209
		Faith that removed—beards	1528
		Fales, Samuel	68
		Fallon Leather Co.	1482
		Falulah Paper Co.	1832
		Fall River Bleachery	174
		Fall River Cement Construction Co.	263
		Fall River Electric Light Co.	186
		Fall River Industrial Buildings, Inc.	188
		Fall River Iron Works	161, 163
		Fall River, Textile City of Globe	160
		Fall River Webbing Mills	182
		Fall River's other industries	186
		Fall River's pioneer concerns	85
		Famous for ships, rum, crackers	938
		Famous for woolen textile and electrical products	102
		Famous Sandwich Glass Works	99
		Famous Ship Builders	388

Famous Worcester anthracite coal mine	1658	First local maker to send shoes south	345
Famous Writers in Atlantic Monthly	1361	First makers of shoes, by year, town	1065
Falmouth products	98	First manufacture of paper	18
Fancy paper boxes	824	First National Stores	1607
Faneuil, Benj.	1249	First newspaper	16
Fanny Farmer Candy Shops, Inc.	874	First petroleum discovered	192
Fargo Co., E. A.	240	First plate glass made in U. S.	134
Farr Alpaca Co.	587	First pot cast preserved	300
Farrington & Hunnewell made silver tableware	1295	First reciprocal 'phone talk in world	1317, 1420
Fascinating Epic of American business	305	First sleeping car built	489
Fashion fads help leathers	380	First smelting furnace	35
Fast growing industrial center	988	First tack machine	1193
Fastest operating rolling mill in world	1682	First U. S. Armory	481
Father John's Medicine	746	First unit of present North Works built in 1834	1665
Father of electric transformer	111	First use of police power	21
Father of "Josh Billings" a Berkshire Co. manufacturer	107	First wind mill was in Watertown	6
Father of World-famous Morgan Mill	1777	First companies	98
Faulkner, Francis	44, 979	Fish industry of Boston, The	1615
Favorably known Westfield industries	655	Fish lines	643
Faxon, Micah	1170	Fish pier, Boston	1240
Feeder added to tack machine	1194	Fisher, Joshua	51
Fell-mongers, glovers, tailors	33	Fisher Co., W. N.	283
Felt, Wm.	69	Fisheries furnished cheap oil	302
Felters Co., Inc., The	1932	Fisk, Moses	83
Fessenden Companies, Inc.	1028	Fisk Rubber Co.	325, 633
Few changes in old established units	579	Fisk Tire Co.	213
Fiberloid Corporation	533	Fiske began knitted products	1005
Fibro Products Co.	216	Fitchburg 1820; ranks second to Holyoke as paper producer, 1821; entrepreneur, Alvah Crocker, 1821; Duck Mills, 1825; Simonds Saw & Steel Co., 1825; Diversified industries of 1827; Paper Co., 1829; produces world's screen plates	1829
Field, Cyrus W., father of Atlantic Cable	1306	Fitchburg Cotton Mfg. Co.	73
Field & Flint Co., Rise of the	1176	Fitchburg Duck Mills	1825
Field & Son, Inc., Walter W.	835	Five Mills and a bleachery added	173
Field & Sons' Nail and Tack Works	232	500—Spindle plant, A	71
Field Mfg. Co., Charles R.	437	Flagg, Gersham	959
Fifteen thousand men employed just before the World War	1072	Flanders Co., L. M.	258
Fifty patents followed	1700	Flash Chemical Co., The	858
Fifty thousand tons of rags	1127	Flashlights	523
Figures on Gardner products	1866	Flatbush Gum and Confectionery Co.	455
Figures on gigantic plant	267	Fleming & Co., E.	1350
Figures, Some significant	222	Fleming Foundry Co.	569
Filene Sons Co., Service depts. of	872	Fleming Machine Co.	1810
Filing Equipment Bureau, Inc.	1598	Flintkote Co., The	1602
Filing Systems	831	Flint Mills	174
Filling up factories formerly idle	616	Florence Community, The	694
Fire Alarm Systems	898	Florence Sewing Machine Co.	695
Fire of 1914, Salem	360	Florence Stove Co.	1858
Firestone Footwear Co.	1007	Florio, Jeremy	35
Firestone Tire & Fabric Co.	213	Foley Paper Co.	569
Firestone Tire & Rubber Co.	178	Folsom Engraving Co.	1496
Firms, Capital, Employees (1837)	741	Food products	874
Firms employed convict labor	776	Forbes Lithograph Mfg. Co.	1631
First American-made flint-locks	482	Ford, Henry	642
First American volume in 70 editions	13	Fore River Shipbuilding Corp.	1070
First American Watch factory	945	Foreign Stamp liked	103
First bicycle ridden around world	646	Forest reserves	450
First bitulithic pavement ever laid	849	Formation of Crompton & Knowles Loom Works	1704
First blotting paper mills in Bay State	152	Formation of Washburn & Moen Mfg. Co.	1671
First bookbinder	15	Forty-four carriage makers in Amesbury	399
First Brick-Kiln at Salem	21	Foss & Bump, Inc.	569
First censorship of press	16	Foss & Co., H. D.	843
First cloth dressing mill	120	Foster, John	16
First copyright law	16, 1249	Foster Machine Co.	652
First cotton mill in China	736	Foster made carriage gears by machinery	399
First customer-owner plan	298	Foster Shoe Co., The A. J.	760
First Emery manufacturer	1922	Foster Spinning Co.	183
First Fall River Textile Unit	161	Founders of America's first flax mill	406
First flax mill in America	406	Four and one-half decades under one manager	1748
First Fourdrinier machine in U. S. made paper in Tyringham	156	Fourdrinier and cylinder paper machines	339
First fulling mill	102		
First in U. S. to use Camel's hair	1052		
First Kerosene oil produced in Waltham	947		
First knit underwear concern to sell to retailer	1036		
First load of ore—mined and hauled	477		

Fourdrinier wires woven.....	496	General Electric born in Boston.....	314
Four miles of vessels built by Fore River Company in 1919.....	1073	General Electric Co.....	308
Fourth largest industry in U. S.....	1344	General Fibre Box Co.....	544, 685
Fox, Capt. William.....	1271	General Findings & Supply Co.....	256
Fox, Charles K.....	346	General Ice Cream Co.....	531
Foxboro Co., The.....	1092	General Photo-Engraving Co.....	553
Framingham.....	988	General Sea Foods Co.....	371
Framingham concerns, various.....	1000	Genesis of Corticelli Silk Co.....	694
Franco-New England Printing Corp.....	953	Genesis of Florence Stove Co.....	1858
Franklin & Co., E. I.....	282	Genesis of Ludlow Associates.....	662
Franklin County industries.....	431	Genesis of Mason Machine Works Co.....	232
Franklin County Lumber Co.....	455	Genesis of Simonds Saw & Steel Co.....	1825
Franklin Creameries, Inc.....	569	Genius of W. Springfield and Russell.....	675
Franklin famed for straw bonnets and textiles.....	1094	Genesis of Worcester's textile machinery supremacy.....	1653
Franklin Hats, Inc.....	186	Georgetown.....	413
Franklin Paper Co.....	585	George Weston Biscuit Co.....	563
Franklin Printing House.....	1336	Germania Mills.....	585
Frary, H. H. & Sons.....	433	Germ of power loom found under Mar-silles quilt.....	1886
Frazer Bedding Co.....	569	Gifford, A. W.....	1737
Free speech denied press.....	17	Gilbert & Barker Mfg. Co.....	504
Free trade O. K.—"Tariff a reall evell".....	23	Gilbert Mfg. Co., Geo. H.....	725
Free trade tariff upsets corporation.....	275	Giles Richardson & Co.....	31
Freedom of ports advantageous.....	23	Gilet Carbonizing Co.....	762
Freeman, Nathaniel.....	26	Gillespie, James E.....	812
"Freeman's Oath" printed.....	13	Gillespie Co., Robert.....	727
Freetown.....	276	Gillette, King C.....	1526
French & Winslow.....	236	Gillette Company's demise exaggerated.....	1533
French Co., A. F.....	753	Gilson, William.....	7
French, Shriner & Urner.....	1489	Gilt Edge Silk Mills.....	214
Friedrich Co., E. H.....	627	Ginghams, sheetings, etc.....	66
Friend Brothers.....	957	Ginn & Co., publishers.....	810
From automobiles to photographs of distinction.....	902	Girard College columns.....	143
From carpetbag to \$300,000 shoe concern.....	1178	Girard Photo Co.....	559
From clipper ships to sheetings.....	356	Giving the humble cod its rightful place in the sun.....	1024
From horns to hoofs.....	1841	Glassine paper.....	674
From 100 pounds to 400 tons of paper.....	1824	Glass works at Sandwich.....	99
From pistols to farm implements.....	718	Glaz, Inc.....	562
Frost Co., The George.....	1446	Glazed kid production increased.....	349
Frothingham & Co., Inc., T. G.....	284	Gleason, K. C., pioneer hatter.....	416
Fruit syrups.....	940	Glendale Elastic Fabrics.....	714
Frye Shoe Co., John A.....	966	Glendale Mills.....	158
Fuller & Cooper.....	640	Glenwood Range Co.....	236
Fuller, Jeduthun.....	40, 62	Glidden, Joseph F.....	1673
Fuller-McFarlane Co.....	256	Glidden & Bigelow heeling machines.....	1156
Furnaces and ranges heat globe.....	226	Globe Knitting Co.....	1583
Furnaces of Plymouth and Bristol counties.....	36	Globe Locomotive Works.....	1327
Furniture factory.....	785	Globe Mill, The.....	83, 161
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Gages, steam and air.....	815	Globe Steam Mills.....	393
Gale, Moses.....	345	Globe Technolian Corporation.....	1020
Gale Brothers.....	473	Globers, Joseph and Jesse.....	13
Games and toys.....	501	Glories of the Future, The.....	2000
Games produced at Salem.....	362	Gloucester enterprises.....	373
Ganewell Co., The.....	898	Gloucester, sea food purveyor.....	368
Gardner, Chair town of Universe.....	1852	Glovers, tailors &c.....	33
Gardner concerns established in '90s.....	1860	Godard, Benjamin.....	1664
Gardner's industrial growth.....	1865	Goddu, Louis.....	1057
Gardner's manufacturers enter new field.....	1862	Goff & Co., D. N.....	641
Gardner's older industries.....	1857	Goffs, The.....	77
Garfield, Benjamin.....	29	Golbert Last Co., The.....	1731
Garrett, George S.....	306	Goldbeaters.....	938
Gas and Electric Sales, customers, by years.....	803	"Gold mines" in North Attleboro.....	289
Gas at \$3.50 in good old days.....	801	Gold pens, printing, horseshoe nails.....	1336
Gas service in days of '49ers.....	800	Goodell & Winn.....	1056
Gasoline pumps.....	507	Goodell Brothers.....	446
Gavitt Mfg. Co.....	1883	Goodell-Pratt Co.....	433
G. C. A. Mfg. Co.....	118	Goodman Co., R. E.....	325
General court grants glass-making right.....	22	Goodspeed Machine Co.....	1990
General court surveys clothing situation.....	27	Goodwin, William.....	11
		Goodyear, Charles.....	210, 712, 816, 1274
		Goodyear begins rubber manufacture.....	494
		Goodyear India Rubber Glove Mfg. Co.....	495
		Gore, Governor Christopher.....	42
		Gores, Samuel and Christopher.....	1255
		Gordon Brothers.....	889
		Gordon Supply Co., Inc.....	1489
		Gorse Co., Frank W.....	1113
		Goshen.....	715

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Gosnold Mills Co.	203	Growth of Lowell cotton textiles.	746
Goss Brothers	179	Growth of N. E. Gas and Electric Association companies	802
Gorton-Pew Fisheries Co., Ltd.	368	Growth of the (fish) industry	1616
Gould & Cutler Corporation	1348	Growth of The Keith Company	1172
"Governor to regulate wheels"	91	Growth of the West Lynn Works	317
Governors among Spaulding products	1029	Guild, Benjamin	777
Gow system of Caisson foundations	1552	Guild, Curtis	1562
Grady & Co., Inc., J. W.	1775	Gunner Mfg. Co., Ralph R.	258
Graft Co., George B.	873	Gun powder made in 1775	389
Grafton's industries	1908	Gurnet Mills	343
Graham's comb factory	1258	Gurney Co., Inc., D. B.	1234
Granby	716	Guyot Bros. Co., Inc.	254
Granite City of Massachusetts	1067	H	
Granite industry of Cape Ann	421	Haarman Steel Co.	627
Granite mills	170	Haartz-Mason Rubber Mfg. Co.	1046
Graton & Knight Co., The	1719	Hadley Spool-Cotton Mf'y	584
Graves patents cordage machine	1273	Hahn Department Stores, Inc.	1341
Gray, Elisha	1409	Hairpin machine utilized	250
Gray, Smith	1133	Hale, Rev. Enoch	716
Gray & Sons, Inc., Peter	820	Hale, Ezekiel	40
Graylock Mills, North Adams	88	Hale, Moses	39, 60
Great Barrington "India Rubber" experiments	143	Hale, Cushman & Flint	1601
Great Barrington's largest enterprise	144	Hale's (Ezekiel) Haverhill Cotton Mill	68
Great White Fleet	1502	Half century of distinguished service	1219
Greatest development made in this decade	270	Hall Co., Martin L.	1291
Greatest invention of nineteenth century—the telephone	1402	Hamblet Machine Co.	339
Greatest textile development in all history	1516	Hamblin & Russell Mfg. Co., Inc.	1769
Greeley, Andrew	345	Hamel Leather Co., The L. H.	349
Green, Samuel, follows Day	14	Hamill, S. S.	779
Green, William S.	1171	Hamilton Bros.	269
Green Co., Richard T.	1630	Hamilton enterprises	737
Green and Prouty enterprises	1954	Hamilton Woolen Co.	1949
Green Mill, The	71, 226	Hammett Co., The J. L.	808
"Green," or Taunton Cotton Mill	71	Hammond Reed Co.	1732
Green Shoe Mfg. Co., Inc.	1589	Hampden Automotive Products, Inc.	537
Greene, Col. Levi R.	1316	Hampden Bleachery	638
Greene, Edwin Farnham	329	Hampden Brass Co.	569
Greene, Mrs.	1982	Hampden County towns—manufactures of	658
Greene & Wood Planing Mill, The	216	Hampden Glazed Paper & Card Co.	597
Greenfield Electric Light & Power Co.	446	Hampden Grinding Wheel Co.	520
Greenfield industries	431	Hampden Lumber Co.	533
Greenfield Mfg. Co.	437	Hampden manufactures	661
Greenfield Tap & Die Corporation	439	Hampden Paint & Chemical Co.	500
Greenfield, tap and die town of world	437	Hampden Paper Co.	585
Greenfield's other industries	452	Hampden Toy Co.	655
Greenleaf Mfg. Co.	188	Hampden Watch Co.	510
Greenman Steel Treating Co.	1804	Hampden Zinc & Lead Co.	531
Greenough, David	78	Hampshire Brick Co.	627, 723
Greenville Mfg. Co.	692	Hampden Cotton Mfg. Co.	662
Greenwich	716	Hampshire County towns in industry	708
Gridley-Downey Co., Inc.	476	Hampshire Leather Mfg. Co.	69
Griess-Pfleger Tanning Co.	1016, 1565	Hampshire Paper Co. started in '60s	722
Griffin Flooring Co.	1801	Hampshire Pearl Button Co.	728
Griffiths, Charles	1294	H. & B. American Machine Co.	1490
Griggs patented railway brake	1297	H. & E. Wrench Co.	216
Grinding machines, cylindrical	1751	Hancock's industries	146
Grinding wheels	657	Hand-made paper	147
Grinnell Mfg. Corporation	199	Hand Method Lasting Machine Co.	1057
Grinnell Yarn Mills, Inc.	183	Handy Chair & Table Co.	561
Griswold, Joseph, Sr.	434	Hanford, George	477
Griswoldville Mfg. Co.	434	Hanover Rubber Co., The	1203
Griswoldville Mfg. Co.'s local plant	462	Hanover's industries	1201
Gross earnings, Edison Co.	1436	Hanson, the state's only producer of industrial lighting equipment	1209
Grossman Co., Louis	188	Hanson's industrial renaissance	1204
Grosvenor Shoe Co., C. A.	1805	Happenings in first quarter of twentieth century	642
Groton	1002	Harding Mfg. Co.	278
Grouse Co., Chas. K.	288	Harding Uniform & Regalia Co.	1522
Grout, Elias	83	Hardwick industries	1909
Groveland Foundry Co.	264	Hardy & Sons Co., Wm. A.	1828
Groveland Mills, The	414	Hardy Co., The L.	1810
Grover & Baker Sewing Machine Co.	1351	Hargraves Mills	177
Grover's Sons Co., J. J.	1026	Harnessing Chicopee River	483
Growth of bonus policy in mill grants	10	Harodite Finishing Co.	269
Growth of Crompton & Knowles Loom Works	1709	Harriman Mill, The	41
Growth of Granite Corporation	424		

Harrington & Richardson Arms Co.	1745	Hicks, Zachariah	1308
Harris & Fisher	252	Higgins, Benjamin	710
Harris Co., George W.	744	Highland Mfg. Co.	627
Harris Shoe Co., The	768	Higgins Industrial Museum	1763
Harris Silk Hosiery Co.	557	Higgins, J. W.	1763
Harrison, John	28	Hildreth, A. G.	1772
Harrison & Co., H.	640	Hildreth's History quoted	81
Harrison Shoe Co.	928	Hill & Cutler Co.	197
Hartwell, Ephraim	41	Hill Clothes Dryer Co.	1797
Hartwell, Jephtha R.	1002	Hill Company, The Howard W.	375, 1595
Hartwell & Brown's Cotton Mill	986	Hill, Samuel L.	694
Harvard industries	1909	Hilliard & Merrill Co.	324
Harvard Pickle Works, Inc.	436	Hinckley, Zenas R.	100
Harvesting vitamins out of codfish	1022	Hingham has few industries	1209
Harwich industries	96	Hingham Knitting Co., The	864
Harwood Counter Co.	324	Hinman Asbestos Corporation	848
Harwood Quincy Machine Co.	1759	Hinsdale's industries	146
Harwood Underwear Co.	215	Historic house of Martin L. Hall Co.	1291
Haskins & Chaffee began making rubber products	1274	Hoadley Portable Engine	328
Hastings, Joseph	776	Hoague-Sprague Corporation	321
Hastings & Schoen	569	Hobart, Col. Aaron	1187
Hatch Co., The C. F.	750	Hobbs Mfg. Co.	1776
Hatch & Barnes Co.	1776	Hobbs, William	492
Hat companies, various	401	Hobson & Lawler Co., The	745
Hated Andrew Jackson	734	Hodges Carpet Co., Inc.	525
Hathaway Bakeries, Inc.	823, 1450	Hodgman Mfg. Co.	242
Hathaway Machinery Co.	217	Hodgman Rubber Co.	1000
Hathaway Mfg. Co.	266	Hodgson, Samuel	70
Hathaway Mfg. Corporation	200	Holbrook industries today	1099
Hatherly, founder of Scituate	5	Holden, James	170
Hatters Fur Mill, The	186	Holland, Homer	655
Hatters, too, want special privileges	30	Holland industries	661
Hathaway & Sons, Inc., C. L.	1345	Hollingsworth, Edmund G.	1260
Haverhill Duck factory	55	Hollingsworth, Mark	19, 1260
Haverhill Gas Light Co.	404	Hollingsworth & Vose Co.	1003
Haverhill industries—various	351	Holliston	1004
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Methuen, a busy industrial town	416	Morart Paper Co., Inc.	618
Metropolis of New England	1236	More, bigger, better ships	1069
Metropolitan Camp Goods Co.	1876	Morey & Son, printers, electrotypes ..	455
Mexican Petroleum Corporation	1640	Morgan, Charles Hill	1776
Meyer Thread Co., John C.	753	Morgan Company's world-wide field of distribution	1778
Michelson, type founder	20	Morgan Construction Co.	1776
Middleboro industries	1212-1214	Morley and Mathison button sewing machine	1162
Middleby, Jos. Jr., Inc.	1384	Morrell Co., John	876
Middlefield products	721	Morris Shoe Co.	242
Middlesex	737	Morse, Andrew J., inventor	1346
Middlesex Bleach, Dye & Print Works ..	883	Morse Blacking Co.	383
Middlesex County's Mfg. Towns	969	Morse Co., Leopold	1342
Middlesex Products Co.	1594	Morse Diamond Cutting Co.	1368
Mifflin, Geo. M.	1332	Morse, Dr. Jedekiah	57
Milford Iron Foundry	1926	Morse, Driscoll, Hunt & Co., Inc.	242
Milford's industries	1925	Morse, Samuel F. B., 57; 1298; con- ceives telegraph idea while at sea, 1299; becomes college professor, 1299; spurred on by act of Congress, 1300; assisted by Alfred Vail, 1301; enlists Congressional support, 1302; grateful to Miss Ellsworth, 1303; offers telegraph to government for \$100,000, 1304; to Europe to interest foreign capital, 1305; given honors at home and abroad, 1306; assured Field's interest in cable,	1307
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Millard Leather Co.	256	Moses, Horace A.	675
Mill bred many inventors, The	59	Moshier Brothers	978
Mill burned in 1868	84	Mossberg, Frank	257
Mill River factory in Worcester	54	Most efficient ship-building plant ..	1
Mill River Machine Shop	572	North of New Jersey	1069
Miller, Dr. Nathaniel	42, 69	Most versatile inventor	1874
Miller Co., Charles N.	1464	Moth Aircraft Corporation	7 8
Miller (K.) Tool & Mfg. Co.	560	"Mother Brook"—Dedham source of Water-power	1089
Miller & Sons Piano Co., Henry F.	1370	Motors and generators	114
Millers Falls Co.	468	Mountain Mill Paper Co.	154
Millers Falls Paper Co.	469	Mount Peak Mine	433
Millers made stove fixtures	706	Mt. Pleasant Mfg. Co.	204
Millett Woodbury Co.	376	Mount Tom Silk Co., Inc.	615
Milliken, Joseph K.	266	Mount Tom Sulphite Pulp Co.	628
Milliken Machine Co.	901	Mt. Tom Thread Co.	712
Million loaves of bread every 48 hours ..	1608	Moulton Ladder Mfg. Co.	885
Millions from auto builders	401	Moxie Co. of America, The	1471
Mills Belt Co., The	1758	Much of modern navy built at Quincy ..	1070
Mills enjoy good credit	225	Mulberry bubble burst	692
Mills established in the '60s	170	Mulvey Yarn & Dyeing Co.	43
Mills Machine Co.	339	Munder Electrical Co.	662
Mills, Some, erected in 1814	86	Munroe, Brown & Co.	640
Millville manufactures	1934	Muran & Co., L. E.	1372
Milton,	1106	Murdock Co., E.	1989
Milton and Dorchester paper mills ..	1249		
Milton Bradley Co.	500		
Milton Chemical Co.	877		
Milton world-famous for Water crack- ers	1108		
Minott Printing & Binding Co.	453		
Minute Tapioca Co.	474		
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Modern Priscilla, The	1473		
Modern Shoe Epic, A	1954		
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Murphy Co., John A.	570	Newcomb, Prof. Simon.....	796
Murray Co., The	1518	New concern for Grafton.....	1908
Murray Printing Co., The	843	New Edge Tool & Machine Co.....	553
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Musical Review	1293	N. E. Aniline Works, Inc.....	978
Musician, The	1293	New England Box Co., 449; Braid Co.,	
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Mystic Iron Works	932	Card & Paper Co., Inc., 570; Coal &	
Mystic Knitting Co.	914	Coke Co., 926; Concrete Pipe Corp.,	
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Nail plant	101	902; Confectionery Co., 855; Corset Co.,	
Nail production	37	1796; Cotton Waste Co., 209; Drawn	
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Nashawena Mills	208	1567; Foundry & Machinery Co., 1565;	
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National Can Co.	1543	Silk Corporation, 1591; Structural	
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National Envelope Co.....	517	New England's largest iron concern in	
National Equipment Co.....	523	1875	1191
National Felt Co.	715	New enterprises in "Lee Shops".....	1877
National Leather Co.	381	New Hampshire Mills; American Wool-	
National Library Bindery Co.....	685	en Co.	1514
National Machine and Tool Co.....	1498	New Holyoke Enterprises.....	625
National Magazine	1385	New Home Sewing Machine Co.....	471
National Needle Co.	512	New Hydro-Electric development.....	577
National Packaging Machinery Co.....	899	New industries to Malden	907
National Papeterie Co.....	517, 556	New magnet and first commercial tele-	
National Remedy Co.....	1579	phone line	1422
National Watch Co.....	1056	New Marlboro's industries.....	154
Natricks Underwear Co.....	528	New Process Twist Drill Co.....	238
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Neapolitan Ice Cream Co.....	838	Orleans papers	1841
Neild Mfg. Co.	208	New textile units of this decade.....	209
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Paper first made	18	bury	398
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Rice Gummer Products Co., Inc.	656	Roy & Son Co., B. S.	1742
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Russell Falls Paper Co.....	674	S. C. S. Box Co., Inc.	673
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Russell Paper Co.....	337	Sea food purveyor—Gloucester	368
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Salem industries, varied	364	Service departments of Filene Sons Co.	872
Salem Iron Mfg. Co.	357	Settling with Western Union	1429
Salem makes Sail-Cloth, or Duck.....	59	Seven newspapers in Massachusetts.....	17
Salem Mercury quoted, 1788	52	Seventy-five per cent of world's screen plates made in Fitchburg	1829
Salem's Transformation	356	Shanks cut, punched, formed in one process	1197
Sales broke all records in 1928.....	1538	Shareholders get half of \$100,000,000 earnings	1536
Sally Middy Co.	188	Sharon Cotton Mfg. Co.	79
Salt and fresh fish	1617	Sharon industries	1123
Salt by Solar Evaporation	11, 25	Sharon Public Library's Scrap book.....	79
Salt, like most products, a monopoly ..	25	Sharp Mfg. Co.	209
Salt price fixed	25	Shattuck Arms Co., C. S.	719
Salt works in Barnstable "on new plan"	26	Shaw, Henry	107
Salvaging waste, materials	117	Shaw, Robert Gould	68
Sample-Durick Co., Inc.	570	Shaw Furniture Co., The	776
Sampson & Murdock Co., The	1325	Shaw Stocking Co., The	751
Samson Cordage Works	1463	Shawmut Engineering Co.	1592
Samson Electric Co.	1045	Shawmut Iron & Wire Works, Inc.....	928
Sanborn & Co., Benjamin H.	1498	Shawmut Mills	183
Sanborn, Carter & Bazin	1331	Shell Eastern Petroleum Products Co.	185, 1612
Sanborn Co., The	869	Shepard, Benjamin	38
Sanders, Inc., Clyde R.	350	Shepard, Silas	40
Sanders, Thomas	1405	Shepard & Morse Lumber Co.	1467
Sanderson & Co., E. P.	828	Shepard Envelope Co., The	1806
Sandisfield's Industrial ventures	156	Shepard's (Benj.) Wrentham mill.....	55
Sandland & Son, C. E.	283	Shepardson & Co., H. S.	479
Sanford, Philo	69	Shepardson Extract Co.	571
Sanford Spinning Co.	178	Sherbet-Taca Co.	532
Sanger, Col. Calvin	43	Sherman Envelope Co.	1784
Sanitary Ice Corporation	563, 566	Sherman Textile Co., The	1804
Santos Co., The	256	Sherwood Curtain Co., Inc.....	243
Saugus	428	Shields Foundry Co.	278
Saunders discovers "White Coal" of Lawrence	327	Shining Example of versatility.....	1841
"Sawed broom corn".....	716	Ship builders of Newburyport	388
Savels & Co., O. M.	1743	Shipbuilding	1630
Saving of rags not habitual	19	Shipbuilding of Mass. an epic.....	3
Saving 100 stops a day on loom	1917	Shipman Machine Co., The	1579
Savings deposits, 1928	2000	Shippee's Stitch-down method	1154
Sawmill's advent	3	Shirley's industries	1021
Sawyer, Jacob H., inventor	750	Shirt companies	1848
Sawyer, Jonathan	419	Shirts, overalls	98
Sawyer & Son, H. M.	784	Shoe and cotton textile center.....	120
Sawyer Lumber Co., W. H.	1745	Shoe and Leather Reporter.....	1385
Sawyer Spindle	750	Shoe machinery inventions	1143
Sash, doors and blinds	567	Shoe production center	1169
Scales of herring utilized	94	Shoe making in Mass.—when, where and by whom begun	1065
Scannell Boiler Works	752	Shoes made by factory system nearly 100 years	965
Scholfield, Arthur	40		
Scholfield, James	418		
Scholfield produces broadcloth in 1804 ..	69		
Scholfields, Arthur and John	57		
Scholfield's double carding machines.....	103		
School supply house.....	808		

Shoes, rugs, braids, laces	754	Sole cutting, channeling and other machines	1160
Shove Mills	174	Some interesting statistics (Boston port)	1242
Shpetner Sons & Co., Inc., Henry	570	Some inventions of Benj. Crehore, of Milton	1106
Shrewsbury	1943	Some Lynn shoe production figures	303
Sickles Co., Inc., F. W.	559	Some major accomplishments of 30 years	310
Siebert Company, O. W.	1863	Some of Cambridge's facilities	774
Significant figures, Some	1616	Some processes carried on at Pittsfield works	115
Significant recent developments	1446	Some recent accessions (Fall River)	188
Silver Lake Co., The	899	Some representative Lynn concerns	324
Silversmithing, start of	389	Some significant figures	222
Simmons & Co., R. F.	250	Some startling statistics	1539
Simons-Hatch & Whitten Shirt Co.	1035	Some 20th Century textile enterprises	203
Simonson, Wilmot H.	940	Some Waltham 20th Century concerns	951
Simplex Time Recorder	1863	Somers, Thomas	31
Simplex Wire & Cable Co.	824	Somerset	294
Simpson, John, Activities of	743	Somerset Stove Foundry Co.	241
Simpson, Michael H.	1348	Somerville	883
Simpson Spring Co.	271	Somerville Iron Foundry	884
Singer Sewing Machine Co. tried twist silk	694	Sommer Co., J. J.	288
Site can be seen today	298	Soule Mill	203
Situation, analysis of the	219	Southboro	1943
Situation as compared with Virginia	1	Southbridge	1944
Six machines invented in 2½ years	92	South Hadley Falls	721
Sizer, E.	641	Southern mills make coarser goods	224
Sjostrom starts dyeing plant	338	Southwell Wool Combing Co.	985
Skalon Whip Co.	532	Southwick, Joseph	379
S. K. C. System and its products	112	Southwick, Lawrence	22
Skeptics and pessimists	799	Southwick Co., The L. B.	382
Skinner & Sons, William	591	Southworth, Col. Edward	1170
Skinner Organ Co.	654, 1540	Southworth Co., The	679
Slade, Henry	1296	Spalding & Bros., A. G.	638
Slade Co., D. & L.	1296	Spared by Indians under King Philip	69
Slade Mills	172	Sparrow, H. F., Candy maker	829
Slater, Horatio N., Jr.	1978	Spartan Saw Works	542
Slater, Samuel	38	Spatula Publishing Co.	1490
Slater, Samuel, builds at Rehoboth	59	Spaulding-Moss Co.	563
Slater used power at Blanchardville	670	Spaulding products	1029
Slater's advent into Webster, 1974; he locates in Pawtucket, 1975; founding of Webster Mills, 1976; visited by President Jackson, 1976; active for schools, 1977; built a railroad, 1977; oldest commission house in U. S., 1978; company, Inc., in 1927	1979	Spears Sons Co., The Alden	798
Slater's (Samuel) venture at Webster	85	Special Tool and Machine Co.	1593
Sleeper & Hartley, Inc.	1800	Special Yarns Co.	1494
Slipper City of the World	345	Spence first to make heels a distinct industry	1225
Small arms made in 1795	482	Spencer, birthplace of Howe	1953
Small Bros., Mfg. Co.	177	Spencer, C. W.	641
Smart Mfg. Co., A. J.	442	Sperry Co., The S. C.	368
Smelter operated in Taunton	231	Sperry & Smith	641
Smelting in Westford in 1710	1051	Spindle City Brass Foundry	771
Smith, Capt. Thomas B.	375	"Spinning School", A	29
Smith, Eleazer	1660	Spitz Nover Co.	563
Smith, Jeremiah	18	Splendor Macaroni Co., Inc.	1592
Smith, John	408	Sporting Goods	529
Smith, Obed E.	26	Sprague, John	54
Smith & Dove Mfg. Co.	409	Sprague & Reynolds Co.	292
Smith & Fyfe, Inc.	1809	Sprague Box Co.	321
Smith & Wesson, Inc.	499	Sprague, Grout & Lowe, Inc.	473
Smith began elimination of waste	370	Sprague industries	473
Smith Carriage Co., The	484	Springfield Arms Co.	499
Smith Co., H. B.	643, 869	Springfield Blanket Co.	586
Smith Co., Thomas	1729	Springfield Brass Co.	520
Smith Co., Inc., Chas. T.	217	Springfield Breweries Co.	531
Smith Iron Works, A. L.	1644	Springfield Brick Co.	531
Smith Mfg. Co., R. H.	510	Springfield Bronze Co.	554
Smith Mills, Inc., The	1805	Springfield Car & Engine Co.	498
Smith Paper Co., Beginnings of	149	Springfield Card Mfg. Co.	484
Smith Tablet Co., Inc.	593	Springfield Coil Boiler Co.	524
Smith's (Harry Worcester) inventions	1704	Springfield concerns est., in 1928-29	561
Smith's (Elijah) notable invention	1133	Springfield concerns having more than one million dollars output yearly	573
S. N. & C. Russell Mfg. Co., 110 years old	107	Springfield Dairy Systems, Inc.	570
Snell Mfg. Co., The	1958	Springfield Drop Forging Co.	524
Snow Mill	611	Springfield Elevator & Pump Co.	521
Snyder, Inc., H. S. & M. W.	1482	Springfield enterprises of the '90s	527
Soap factory of 1856	97	Springfield Facing Co.	639
Soap made in Cambridge	779	Springfield Foundry Co.	511
		Springfield Gas Light Co.	498
		Springfield, industrial beehive	481

Springfield Iron Works, Inc.	527	Sterling Knit Goods Co.	241
Springfield Knitting Co.	517	Sterling Mills, The.	752
Springfield Lumber Corp.	570	Sterling Ring Traveler Co.	187
Springfield Machine Screw Co.	527	Sterling silver craftsmen.	445
Springfield Manufactures—Other.	567	Sterling Textile Co.	557, 570
Springfield Metal Stamping & Tool Co.	561	Stetson Shoe Co., Inc., rise of.	1137
Springfield Mfg. Statistics, Civil War period.	501	Stevens & Sons Co., M. T.	68, 406
Springfield Paper Co.	511, 556	Stevens, Arlin V.	711
Springfield Photo Mount Co.	559	Stevens Arms & Tool Co., J.	630
Springfield Planing & Moulding Co.	527	Stevens erected shoe factory, 1838.	965
Springfield Plating Works.	493	Stevens Linen Co., of Dudley.	84
Springfield Printing & Binding Co.	570	Stevens Mfg. Co.	179
Springfield products of 1868-9.	510	Stevens, Nathaniel.	406
Springfield Provision Co.	639	Stevens-Walden-Worcester, Inc.	1793
"Springfield Republican" (1829) quoted.	485	Stewart & Son, C.	1737
Springfield Steam Power Co.	518	Stewart Bro's. Co.	820
Springfield Tool Co.	500	Stickney & Poor Spice Co.	1271
Springfield Upholstery & Metals Co.	531	Smith, Jeremiah.	1260
Springfield Weaving Co.	517	Stiles & Hart Brick Co.	242
Springfield Wire & Tinsel Co.	570	Still progressing and expanding.	1075
Springfield's diversified products.	572	Stillson Wrench, The.	1316
"Spy", April, 1789, quoted.	1652	Still the dominant unit in industry.	648
Squire & Co., John P.	218, 785	Stimpson, George, Jr.	1336
Squirrel Brand Co., The.	839	Stimson, John.	422
Stacy-Adams Co.	1178	Stockbridge, Charles.	8
Stacy Machine Works.	510, 570	Stockbridge Machine Co.	1784
Stafford Mills.	173	Stockbridge's industrial ventures.	156
"Stained paper".	20	Stoddard, J. C., inventor of Caliope.	1728
Standard Action Co., The.	835	Stohn, Inc., Carl.	1523
Standard Brick Co.	520	Stone, Henry N.	1364
Standard Button Co.	524	Stone, Joseph M.	420
Standard Corset Co.	628	Stone, Malcolm B.	664
Standard Crayon Mfg. Co.	412	Stone & Forsyth Co.	924
Standard Diary Co., The.	796	Stone & Webster, Inc.	1479
Standard Electric Time Co.	538	Stone, Great Rockes of.	21
Standard Fabric Co.	182	Stone Mill, The.	60
Standard Fibre Products Co.	1044	Stoneham industries.	1022
Standard Foundry Co.	1773	Story of Edwin Clapp & Son, Inc.	1135
Standard Horse Shoe Co.	1230	Story of Lever Bro's. Co., The.	844
Standard Jewelry Co.	254	Story of Morgan Co's. growth.	1779
Standard Oil Co. of New York.	1575	Stoughton industries.	1123
Standard Ring Traveler Co.	216	Stoughton Mill on Neponset River.	7
Standard Rubber Co.	279	Stover & Bean Co., The.	756
Standard Specialty Mills.	183	Stoves, kettles, hollowware.	101
Standard Stove Lining Co.	243	Stow.	1027
Standard Turning Works, The.	807	Stowe & Woodward Co., The.	900
Standish Worsted Co.	1224	Strahan Co., Thomas.	1635
Stanhope Co., A. B.	762	Straker & Freeman.	287
Stanley, William.	111	Strange's Machine Works.	232
Stanley, Kelly, Chesney (system).	112	Strathmore Paper Co.	652, 675
Stanley Rule & Level Co.	431	Stratton, Daniel.	1006
Stanley Woolen Co.	1968	Straw carpetings offered in 1818.	483
Stanton, Henry E.	721	Straw hat makers.	708
Star Refining Co., The.	1487	Straw hat making begun.	1005
Star Worsted Co.	1835	Streeter & Co., C. E.	253
Starbuck, Walter F.	81	Stretton & Son Co., Charles.	1124
Starrett Co., L. S.	1871	Strike of 1928, The.	224
Started in a barn.	236	"Struggling industries" in 18th cen- tury.	37
State's contribution to internal reve- nue receipts.	1999	Stuart & Co., Wm.	343
Statistics of Leominster manufacturers.	1851	Stuart Laundry Machinery Co.	563
Statistics on Attleboro mfg. establish- ments in 1927.	262	Studson, Robert.	5
Statistics on Everett.	916	Stuebing-Cowan Co.	619
Stearns Lumber Co., A. T.	1334	Stupendous developments of last five years.	1437
Stearns, Perry & Smith Co.	1591	Sturbridge.	1957
Stebbins, Joseph.	435	Sturbridge Mfg. Co.	83
Stebbins Mfg. Co., M. D.	528	Sturdy, James H.	280
Stebbins patents water faucet.	499	Sturdy Brothers.	292
Steck Piano Co., Geo.	1352	Sturdy's Sons Co., J. F.	248
Stedman rake factory.	156	Sturtevant, Benjamin F.	1143
Steel manufacture started.	36	Sturtevant Co., B. F.	1386
Stellar invention, The.	1156	Sturtevant Mill Co.	1459
Stellar inventions of Draper family.	1910	Sturtevant pegging machine.	1145
Steel mills representatives.	805	Sturtevant-Whiting Co.	282
Steel Products Mfg. Co.	656	Subsidiary companies (Warren Bro's. Co.)	852
Steel Shot & Grit Co.	404	Success Mfg. Co.	372
Steere & Son Organ Co., J. W.	532	Successfully meeting a crisis.	967
Stephens Mfg. Co., A. W.	955	Sudanette Co., The.	205

Sudbury	1028	Taylor Logan Co., paper makers.....	628
Suffolk	737	Tax on carriages removed.....	30
Suffolk Engraving and Electro. Co.....	818	Tecumseh Mills	171
Suffolk Knitting Co.....	762	Ted Shea Oar Co.....	562
Suffolk Mfg. Co.....	743	Telephone invented	1402
Sumner, Gen. W. H.....	1134	Templeton industries	1963
Superba Towel Co.....	180	Ten carloads of paper made each day	607
Superior Corundum Wheel Co.....	951	Tennel Co., The	259
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Sutton, Wm. P.....	857	Tenney & Co., Chas. H.....	364, 1520
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Sutton's industries	1963	Terminal Wharf Co.....	1605
Sutton's mills	419	Tewaldi Supply Co.....	562
Swampscott	429	Textile Belting & Strapping Co.....	187
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Swift & Co.....	381	Textile mfr. began in Billerica in 1811	979
Swift & Fisher	286	Textile Mfg. Co.....	652
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Taber's Mills (cotton).....	263	Textile workers got brick sidewalk..	733
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Tailby-Nason Co., The.....	860	Theodore Schwamb Co.	970
Talbot & Co., C. P.....	742	There were mfg. problems in olden days	291
Talbot Mills, The.....	980	There were objectors, even then.....	1068
Talbot Wool Combing Co.....	292	Thermatrol Mfg. Co.....	560
Tanners Products Co.....	384	"The Vacant Chair".....	1669
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Taunton Wool Stock Co.....	240	Tiffany, Bela	45
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Various Watertown industries-----	1050	Warren, Arthur G.-----	1684
Various Webster industries-----	1981	Warren Belting Co.-----	1810
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Various Woburn industries-----	963	Warren Co., S. D.-----	1349
Various Worcester industries-----	1811-1819	Warren Gear Co.-----	976
Varney & Sons Co., Isaac-----	187	Warren Leather Goods Co.-----	1769
Varying style changes in tacks-----	1196	Warren Mfg. Co.-----	568, 639
Vaughn, J. C., inventor-----	382	Warren Pipe & Foundry Co.-----	934
Vegex Vitamin Yeast Extract-----	651	Warren Soap Mfg. Co.-----	810
Vellumoid Co., The-----	1805	Warren Steam Pump Co.-----	1973
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Vose-Swain Engraving Co.-----	1566	Washburn Co., wire goods division-----	1760
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Walker, Thomas-----	1005	Watch hands-----	1056
Walker & Pratt Mfg. Co.-----	1037	Watch keys-----	516
Walker Body Co.-----	405	Watch repairers' tools-----	947
Walker Co., Inc., O. S.-----	1794	Waterhead Mills, Inc.-----	761
Walker, Davison & Co.-----	279	Waterman, John-----	66
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Wallace Nutting, Inc.-----	998	Water-mills erected in Plymouth Colony-----	8
Wallace, Rodney-----	74	Water-mills set up-----	10
Walpole industries-----	1126	Waterproof hats-----	784
Walsh Holyoke Steam Boiler Works, Inc.-----	623	Waters Governor Co.-----	923
Walsh Steam Boiler Works, Inc.-----	623	Waterside mills-----	763
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Waltham Bleaching & Dye Works-----	943	Watson enters Bell's life-----	1407
Waltham claim to priority-----	50	Watson Mfg. Co.-----	1923
Waltham concerns established in the '80s-----	948	Watson, Newell & Co.-----	250
Waltham concerns of today, other-----	954	Watson-Park Co., The-----	766
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Waltham Machine Works-----	950	Weather vanes-----	954
Waltham Watch Co.-----	944, 1056	Webb, Francis-----	4
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